

PROJECT SPECIAL PROVISIONS

Project No.: 17BP.5.H.1 Wake County

SCOPE OF WORK

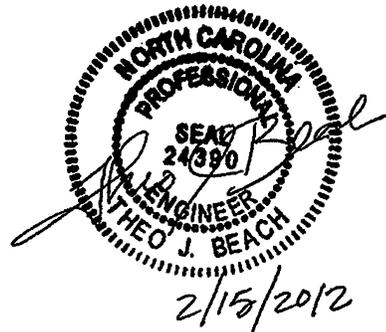
This work shall consist of furnishing all labor, equipment, and materials to rehabilitate elements of existing bridge structures and overlay existing bridge decks with latex modified concrete as directed in the plans. Work includes: portable lighting, existing deck surface preparation, removing deteriorated concrete using hydro-demolition methods and overlaying with latex modified concrete, milling of roadway approaches, disposal of waste material, installing foam joint seals, grooving bridge deck, substructure and superstructure repairs using concrete repairs, shotcrete repairs and epoxy resin injection, removal and replacement of guardrail, structural steel painting, asphalt paving approaches, pavement markings, seeding and mulching all grassed areas disturbed; and all incidental items necessary to complete the project as specified and shown on the plans. No separate payment will be made for portable lighting as the cost of such is incidental to the work being performed.

Work will be performed on existing bridges at the following locations:

- 1.) Wake County Bridge #7 – SR2215 over Neuse River (Latex Modified Concrete Overlay – Very Early Strength, Removal and Replacement of Guardrail)
- 2.) Wake County Bridge #169 – US 64EB Bus. over Neuse River (Latex Modified Concrete Overlay – Very Early Strength, Substructure Repairs)
- 3.) Wake County Bridge #169 – US 64WB Bus. over Neuse River (Latex Modified Concrete Overlay – Very Early Strength, Substructure Repairs)
- 4.) Wake County Bridge #200 – SR1800 (Fairview Rd.) over US 1 (Latex Modified Concrete Overlay, Substructure Repairs, Painting Structural Steel)
- 5.) Wake County Bridge #213 – SR1728 (Wade Ave.) over US 1 (Substructure Repairs)

Contractor shall provide all necessary access; provide all traffic control; provide all staging areas, material storage, waste disposal, provide environmental controls to limit loss of materials into water and air including tarp lined boats or barges for collection of hydro-demolition water; jacking equipment, sawing equipment, and chipping equipment; and all else necessary to complete the work

The contractor shall be responsible for fulfilling all requirements of the NCDOT Standard Specifications for Roads and Structures dated January 2012, except as otherwise specified herein.



MAINTENANCE AND PROTECTION OF TRAFFIC
BENEATH PROPOSED STRUCTURE AT STATION 60+57

(8-13-04)

GENERAL

Maintain traffic on Capital Blvd. as shown in Traffic Control Plans and as directed by the Engineer.

Provide a minimum temporary vertical clearance of 14'-10" at all times during construction.

Submit plans and calculations for review and approval for protecting traffic and bracing girders, as described herein, at the above station before beginning work at this location. Have the drawings and design calculations prepared, signed, and sealed by a North Carolina Registered Professional Engineer. The approval of the Engineer will not relieve the Contractor of the responsibility for the safety of the method or equipment.

PROTECTION OF TRAFFIC

Protect traffic from any operation that affords the opportunity for construction materials, equipment, tools, etc. to be dropped into the path of traffic beneath the structure. Based on Contractor means and methods determine and clearly define all dead and live loads for this system, which, at a minimum, shall be installed between beams or girders over any travelway or shoulder area where traffic is maintained. Install the protective system before beginning any construction operations over traffic. In addition, for these same areas, keep the overhang falsework in place until after the rails have been poured.

BRACING GIRDERS

Brace girders to resist wind forces, weight of forms and other temporary loads, especially those eccentric to the vertical axis of the member during all stages of erection and construction. Before casting of intermediate diaphragms, decks, or connecting steel diaphragms do not allow the horizontal movement of girders to exceed ½ inch.

BASIS OF PAYMENT

Payment at the contract unit prices for the various pay items will be full compensation for the above work.

REMOVAL AND REPLACEMENT OF STEEL BEAM GUARDRAIL (SPECIAL)**DESCRIPTION**

This work consists of removing the existing guardrail in accordance with Section 863 of the *Standard Specifications* and replacing the steel guardrail to the limits and details as indicated in the plans prior to traffic being placed adjacent to the rail. The work shall be accomplished in accordance with the staging detailed in the Traffic Control Plans.

MATERIALS

For guardrail materials, see Sections 862 and 1046 of the *Standard Specifications* and the Standard for Type III Modified for Post and Beam Rail in the plans.

Work shall be accomplished in accordance with Sections 862 and 1046 of the *Standard Specifications*.

Guardrail removal and replacement shall be accomplished after all deck rehabilitation and paving work has been completed. After traffic has been staged for the guardrail work in accordance with the Traffic Control Plans, the existing guardrail shall be removed and replaced. Once guardrail is removed at any location, Traffic Control shall remain in place until the guardrail is replaced. Work may be limited as necessary at the direction of the Engineer in order to maintain guardrail protection at any location on the project. If galvanization is damaged during installation, it shall be repaired according to Section 1076-7 of the *Standard Specifications*.

MEASUREMENT AND PAYMENT

Payment for removal and replacement of steel beam guardrail, including but not limited to, Type III Modified Anchor Units, Guardrail Anchor Units, Type 350 and any other applicable end treatments, will be at the Lump Sum contract price bid for "Removal and Replacement of Steel Beam Guardrail". Prices and payment will be full compensation for furnishing all material, labor, tools, and equipment necessary.

GUARDRAIL ANCHOR UNITS, TYPE 350:

(4-20-04) (Rev. 8-16-11)

862

SP8 R65(Revised)

Description

Furnish and install guardrail anchor units in accordance with the details in the plans, the applicable requirements of Section 862 of the *2012 Standard Specifications*, and at locations shown in the plans.

Materials

The Contractor may at his option, furnish any one of the guardrail anchor units or approved equal.

Guardrail anchor unit (ET-Plus) as manufactured by:

Trinity Industries, Inc.
2525 N. Stemmons Freeway
Dallas, Texas 75207
Telephone: 800-644-7976

The guardrail anchor unit (SKT 350) as manufactured by:

Road Systems, Inc.
3616 Old Howard County Airport
Big Spring, Texas 79720
Telephone: 915-263-2435

Prior to installation the Contractor shall submit to the Engineer:

- (A) FHWA acceptance letter for each guardrail anchor unit certifying it meets the requirements of NCHRP Report 350, Test Level 3, in accordance with Article 106-2 of the *2012 Standard Specifications*.
- (B) Certified working drawings and assembling instructions from the manufacturer for each guardrail anchor unit in accordance with Article 105-2 of the *2012 Standard Specifications*.

No modifications shall be made to the guardrail anchor unit without the express written permission from the manufacturer. Perform installation in accordance with the details in the plans, and details and assembling instructions furnished by the manufacturer.

Construction Methods

Guardrail end delineation is required on all approach and trailing end sections for both temporary and permanent installations. Guardrail end delineation consists of yellow reflective sheeting applied to the entire end section of the guardrail in accordance with Article 1088-3 of the *2012 Standard Specifications* and is incidental to the cost of the guardrail anchor unit.

Measurement and Payment

No separate measurement or payment will be made for Guardrail Anchor Unit, Type 350 as the cost of such will included in the lump sum price paid for *Removal and Replacement of Steel Beam Guardrail*.

HYDRO-DEMOLITION OF BRIDGE DECK

SPECIAL

1.0 DESCRIPTION

Hydro-demolition shall consist of the removal of the deck surface by means of high pressure water blasting which will remove concrete, asphalt, oil, dirt, concrete laitance and rust from the exposed reinforcing bars by direct impact, pressurization of micro and macro cracks and cavitations produced by jet instability. If reinforcing bars or bridge drainage devices are pulled up or snagged during scarification milling operations, the Contractor shall cease operations and consult with the Engineer to determine what adjustments, if any, need to be made to the rotomilling operations.

The Contractor shall submit for approval prior to beginning work, his Hydro-demolition Management Plan. This plan shall include how the Contractor shall provide for the collection, treatment, and disposal of all run-off water generated by the scarification and hydro-demolition processes. This Water Management Plan shall be prepared in accordance the NCDOT Guidelines for Managing Hydro-demolition Water. The contractor shall comply with applicable regulation concerning such water disposal.

2.0 EQUIPMENT

Use the following surface preparation equipment:

- Hydro-demolition machine, self-propelled with min. 17,000 psi orifice pressure.

- Sawing equipment capable of sawing concrete to the specified depth.
- Scarifying equipment that is a power-operated, mechanical scarifier or grinder capable of removing at least 1/4 inch (6 mm) for each pass.
- Hand-held high velocity (7,500 psi minimum) water-jet equipment capable of removing rust scale from reinforcing steel, or removing small chips of concrete partially loosened by the scarifying or chipping operation, and of removing rehydrated dust left from scarification.
- Power driven hand tools for removal of unsound concrete are required that meet the following requirements:
 - Pneumatic hammers weighing a nominal 35 lb (16 kg) or less.
 - Pneumatic hammer chisel-type bits that do not exceed the diameter of the shaft in width.
- Hand tools such as hammers and chisels for removal of final particles of unsound concrete.
- Vibratory screed for overlays, except as noted herein.

The hydro-demolition machine shall be self-propelled and capable of producing a water-jet through an orifice at a pressure of at least 17,000 psi. The machine shall move the jet transversely across the area and forward and backward so that the entire deck is covered with the water-jet and operated at a pressure sufficient to remove the unsound concrete.

The machine shall have sufficient means to control and vary the following functions:

- (1) Water pressure.
- (2) Angle and distance of the orifice in relation to the surface to be blasted.
- (3) Limits of transverse and longitudinal movement of the orifice.
- (4) Speed of the orifice in the transverse and longitudinal direction.

The high pressure pump (or pumps) shall be equipped with over-pressurization relief valves and rupture disc systems. All high pressure components shall be rated at full working pressure of the hydro-demolition system. The complete hydro-demolition system must be capable of depressurization from a single point.

The equipment must operate at a noise level of less than 90 decibels at a distance of 50 feet.

3.0 CONSTRUCTION METHODS

Remove all existing asphalt overlays and all loose, disintegrated, unsound or contaminated concrete from the bridge deck in accordance with the following surface preparation classifications shown below:

Seal all expansion joints subjected to run-off water from the hydro-demolition process with material approved by the Engineer, prior to beginning the Class I Surface Preparation. The

expansion joints shall remain sealed until water from the hydro-demolition process no longer passes over them. The contractor shall take all steps necessary to eliminate the flow of water through the expansion joints, and any other locations water could leak from the deck.

All deck drains in the immediate work area and the other sections of the bridge affected by the work being performed in the immediate work area shall be sealed prior to beginning the Deck Scarification. They shall remain sealed until it has been determined that materials from the hydro-demolition and concrete overlay operations cannot be discharged through them any longer.

- A. Scarifying Bridge Deck: Removal of any asphalt wearing surface from the bridge deck or if applicable, the approach roadway pavement, and scarification of the concrete deck to remove the entire concrete surface of the deck to a uniform depth not less than ½” above the top mat of steel and not less than ½” above the plan demolition depth (1/2” minimum hydro-demolition required).

Estimated Average Rebar Cover:

Bridge #007: 1 ½” +/-3/8”

Bridge #169: 1 ½” +/-3/8”

Bridge #170: 1 ¼” +/-3/8”

Bridge #200: 1 ¼” +/-3/8”

Remove and dispose of all concrete and asphalt, and thoroughly clean the scarified surface. In areas where reinforcing steel is located in the depth to be scarified, use another method with the Engineer’s approval. If reinforcing bars or bridge drainage devices are pulled up or snagged during scarification milling operations, the Contractor shall cease operations and consult with the Engineer to determine what adjustments, if any, need to be made.

- B. Class I Surface Preparation (Partial Depth): Remove by hydro-demolition and by chipping with hand tools all loose, unsound and contaminated deck concrete and in areas where reinforcing steel is exposed by removing deck to an average depth of ½ inch below the top mat of reinforcing steel or as shown on the contract drawings. Dispose of the removed concrete, clean, repair or replace rusted or loose reinforcing steel, and thoroughly clean the newly exposed surface.

Care shall be taken not to cut, stretch, or damage any exposed reinforcing steel.

- C. Class II Surface Preparation (Partial Depth): Remove by hydro-demolition and by chipping with hand tools all loose, unsound and contaminated deck concrete to an average depth of approximately one-half the deck thickness, but no less than ¾ inch below the top mat of steel. In areas where the entire perimeter of the reinforcing steel bar is exposed, chip or use hand-held high velocity water-jet equipment to provide a minimum depth of ¾ inch below the bar. Dispose of the removed concrete, clean, repair or replace rusted or loose reinforcing steel, and thoroughly clean the newly exposed surface.

Care shall be taken not to cut, stretch, or damage any exposed reinforcing steel.

In overhangs, removing concrete areas of less than 0.60 ft²/ft length of bridge without overhang support is permitted unless the Engineer directs otherwise. Overhang support is

required for areas removed greater than 0.60 ft²/ft length of bridge. Submit details of overhang support to the Engineer for approval prior to beginning the work.

- D. Class III Surface Preparation (Full Depth): Remove by hydro-demolition, and chipping with hand tools all loose, unsound and contaminated deck concrete to the full slab depth. Thoroughly clean the routed out areas and dispose of concrete removed and clean, repair, or replace reinforcing bars.

For areas of less than 3 ft² suspending forms from existing reinforcing steel using wire ties is permitted. For larger areas, support forms by blocking from the beam flanges, or other approved method.

Overhang support is required for full depth removal adjacent to bridge rails. Submit details of overhang support to the Engineer for approval prior to beginning the work.

- E. Under Deck Containment: Under deck containment shall be installed under areas of the bridge deck where Class III surface preparation occurs. The containment shall be installed prior to hydro-demolition in the areas indicated on the plans and in any other areas where blow thru or full depth removal occurs during surface preparation.

Submit for approval detailed plans for under deck containment. Detail how waste, debris, and wastewater are kept from falling below.

- F. Class AA Concrete: Fill the Class III surface preparation areas with Class AA or latex modified concrete up to the bottom of the proposed concrete overlay in accordance with the methods described below:

Refill areas where concrete was removed with Class AA concrete up to the bottom of the proposed concrete overlay in accordance with Section 420 of the Standard Specifications.

Any of the methods for curing Class AA concrete as stated in the Standard Specifications are permitted except the membrane curing compound method.

Provide a raked finish to the surface of the Class AA concrete to provide a minimum relief of 1/16" and a maximum relief of ¼". Place the overlay course only after the Class AA concrete has attained 2500 psi (17.2 MPa) as measured by an approved, non-destructive test method.

Refilling the areas from which concrete has been removed with latex modified concrete during the Class III repair is permitted if any of the following conditions are met:

- The reinforcing steel cover is 1½ inches or less for the top mat of steel.
- The area being repaired is less than 1 yd².
- The Engineer directs the fill.

For areas of less than 3 ft² suspending forms from existing reinforcing steel using wire ties is permitted. For larger areas, support forms by blocking from the beam flanges, or other approved method.

4.0 SURFACE PREPARATION

Two trial areas shall be designated by the Engineer to demonstrate that the equipment, personnel, and methods of operation are capable of producing results to the satisfaction of the owner's Engineer. The first trial area shall consist of approximately 50 square feet of sound concrete as determined by the Engineer. The equipment shall be calibrated to remove the sound concrete an additional 1 inch from the scarified surface. After completion of this test area, the equipment shall be moved to the second area consisting of deteriorated or defective concrete, to determine whether this unsound concrete will be completely removed with the previous calibration and to establish a baseline for requiring the contractor to place under-deck containment in areas subject to full depth removal, before beginning the hydro-demolition process in a span. Should it be determined that not all defective concrete has been removed, the hydro-demolition system shall be recalibrated to remove an additional 1/4 inch of sound concrete, then re-test on deteriorated concrete.

If additional defective concrete is found, the depth of cut will increase in 1/4 inch increments until only sound concrete is found remaining.

When satisfactory results are obtained, the machine parameters shall be used for production removal. The contractor shall make adjustments to the operating parameters, as required, to perform concrete removal as indicated on the drawings and to adjust to the variance in the compressive strength of the concrete.

Hand held water blasting equipment, pneumatic hammers, and hand tools may be substituted for the hydro-demolition unit in areas inaccessible (such as adjacent to the curb) or inconvenient (such as small patch areas).

The Engineer will re-inspect after each removal and require additional removals until compliance with plans and specifications are met.

Regardless of the method of removal, the removal operation shall be stopped if it is determined that sound concrete is being removed. Appropriate recalibration, or change in equipment and methods shall be performed prior to resuming the removal operation.

The Contractor shall take all steps necessary to prevent cutting or otherwise damaging existing steel designated to remain in place. Any such bars damaged (nicks deeper than 20% of the bar diameter) by the Contractor's operation shall be repaired or replaced. Defects in embedded reinforcing steel due to corrosion, which has reduced the cross sectional area of the steel by 25% or greater shall have new reinforcing steel of similar cross section area lap-spliced to each side of the damaged area. Reinforcing bars shall be Grade 60 and meet the material requirements of Section 1070 of the Standard Specifications. Replacement bars shall be spliced to existing bars using either minimum 30 bar diameter lap splices or approved mechanical connectors.

The Contractor shall support and protect the exposed reinforcing steel, which is left unsupported by the hydro-demolition process, against displacement and damage from loads such as those caused by removal equipment and delivery buggies. All reinforcing steel damaged or dislodged by these operations shall be replaced with bars of the same size at the contractor's expense.

Rebar exposed and cleaned by hydro-demolition shall not require re-cleaning if encased in concrete within seven (7) days. Rebar exposed for more than seven (7) days shall be cleaned by high velocity water jets (4,000 PSI minimum) prior to placement of the new concrete.

When large areas of the deck on composite bridges are removed resulting in the debonding of the main stress carrying longitudinal reinforcing bars, the removal shall be performed in stages to comply with the construction sequence shown on the plans or as directed by the Engineer.

The Contractor shall shield his operations to prevent injury or damage from flying or falling debris. The Contractor shall provide a method of handling expected and unexpected blow-through of the deck where shown on the plans and as directed by the Engineer. This method shall provide for the containment of the runoff water and debris, and the protection of the area under the bridge deck. The Contractor shall be responsible for any injury or damage caused by his operations. The containment shall remain in-place until the latex modified concrete has been cast and reach minimum strength.

The removal area shall be thoroughly cleaned of all dirt, foreign materials and loose concrete to the extent necessary to produce a firm solid surface for adherence of new concrete.

Removal of concrete debris shall be accomplished either by hand or by mechanical means capable of removing wet debris and water all in the same pass and directly follow the hydro-demolition process to prevent the debris from re-setting or re-adhering to the surface of the remaining sound concrete. All concrete debris shall become the property of the Contractor and shall be legally disposed of at the contractor's expense. The contractor shall be responsible for disposing of all debris generated by the scarification operations.

Any debris which is allowed to re-settle or re-adhere to the surface of the sound concrete shall be carefully removed by the Contractor (at no additional cost), and the Contractor shall exercise care to avoid any damage to the remaining sound concrete or exposed reinforcement. Following the removal of the debris and prior to the placement of the overlay, the entire surface shall be blasted clean with high pressure water to remove any bond-breaking residue, loose material from the concrete surface, and/or rust from the reinforcing steel. This residue shall be collected and disposed of by the contractor. The Contractor will not be permitted to allow material to fall from the deck.

All water used for hydro-demolition shall be potable. The Contractor is responsible for furnishing all of the water required for the project.

Any areas of the prepared surface contaminated by oil or other materials detrimental to good bond as a result of the contractor's operations shall be removed to such depth as may be required at the contractor's expense.

The Contractor shall provide adequate lighting as required to allow for the safe conduct of nighttime removal operation if he elects to do hydro-demolition at night. Submit a lighting plan to the Engineer for approval prior to beginning work.

5.0 MEASUREMENT AND PAYMENT

Scarifying Bridge Deck will be measured and paid for by the contract unit price per square yard and shall be full compensation for the milling of any existing asphalt wearing surface from the bridge deck or approaches, milling of the entire concrete bridge deck, repairing or replacing any damaged reinforcing steel, and the cleaning and disposal of all waste material generated.

Hydro-demolition of Bridge Deck will be measured and paid for by the contract unit price per square yard and shall be full compensation for Classes I, II, and III deck preparation, removal and disposal of unsound and contaminated concrete, cleaning, repairing or replacing of reinforcing steel, under deck containment, Class AA concrete, and for furnishing all materials, labor, tools, equipment and incidentals necessary to complete the work.

Payment will be made under:

Pay Item	Pay Unit
Scarifying Bridge Deck	Square Yard
Hydro-demolition of Bridge Deck	Square Yard

MANAGING HYDRO-DEMOLITION WATER**(6-17-08)****1.0 DESCRIPTION**

Collect and properly dispose of hydro-demolition water from bridge decks.

2.0 CONSTRUCTION METHODS

Prepare a written hydro-demolition water management plan in accordance with the Guidelines for Managing Hydro-demolition Water available at <http://www.ncdot.gov/projects/ncbridges/#stats>. Submit plan and obtain approval from the Engineer prior to beginning of the hydro-demolition operation.

Prior to final payment, submit a paper copy of all completed records pertaining to disposal of hydro-demolition water.

3.0 MEASUREMENT AND PAYMENT

Payment for collecting, sampling, testing, pH adjustment, monitoring, handling, discharging, hauling, disposing of the hydro-demolition water, documentation, record keeping, and obtaining permits if applicable, shall be included in the payment for other items.

LATEX MODIFIED CONCRETE - VERY EARLY STRENGTH**SPECIAL****1.0 DESCRIPTION**

This work consists of furnishing and placing an overlay of latex modified concrete-very early strength (LMC-VES) over conventional existing concrete or repair concrete on bridge decks.

Unless otherwise indicated on the plans, groove the bridge floor in accordance with Subarticle 420-14(B) of the *Standard Specifications*.

2.0 MATERIALS

For equipment, proportioning and mixing of modified compositions, see Section 1000-8 of the *Standard Specifications*. Prior to beginning any work, obtain approval for all equipment to be used for deck preparation, mixing, placing, finishing, and curing the latex modified concrete.

For material of modified compositions, revise the *2012 Standard Specifications* as follows:

A. **Page 10-8, Subarticle 1000-7(A), lines 24-25**, replace the last paragraph with the following:

1. Cement – For latex modified concrete-very early strength, Cement shall be approximately 1/3 calcium sulfoaluminate (C4A3S) and 2/3 dicalcium silicate (C2S) or other hydraulic cement that will provide a Latex-Modified Concrete that meets the physical requirements for Latex-Modified Concrete as indicated in this special provision.

B. **Page 10-9, Table 1000-5 PROPERTIES OF LATEX MODIFIED CONCRETE**, add the following:

1. Minimum compressive strength, normal setting concrete, 3000 psi at 7 days; very early strength concrete, 3000 psi at 3 hours.
2. Water-Cement Ratio by weight, normal setting concrete, maximum 0.40; very early strength concrete, maximum 0.42

C. **Page 10-11, last paragraph of 1000-8**, add the following:

1. Submit the latex modified concrete mix design, including laboratory compressive strength data for a minimum of six 4-inch by 8-inch cylinders at the appropriate age (7 days for normal setting concrete; 3 hours for very early strength concrete) to the Engineer for review. Include test results for the slump and air content of the laboratory mix. Perform tests in accordance with AASHTO T 22, T 119 and T 152.

3.0 SYSTEM QUALITY SUBMITTALS

Past Performance Submittal: At the preconstruction conference, the latex modified concrete overlay Contractor shall submit verifiable records demonstrating that he or his approved subcontractor has performed satisfactorily, or that he has had direct supervision of such satisfactory performance of a sub-contractor constructing contracts using very early strength latex modified concrete. At least five (5) bridges with similar scope of work in any state shall be the minimum number demonstrated.

4.0 CONSTRUCTION METHODS

A. **Preparation of Surface:** Completely clean all surfaces within the 48 hours prior to placing the overlay unless otherwise approved.

Thoroughly soak the clean surface for at least 2 hours immediately prior to placing the latex modified concrete. After soaking the surface for at least 2 hours, cover it with a layer of white opaque polyethylene film that is at least 4 mils (0.100 mm) thick. Immediately prior to placing the latex modified concrete, remove standing water from the surface.

- B. Placing and Finishing: Prior to placing modified material, install a bulkhead of easily compressible material at expansion joints to the required grade and profile. Placing material across expansion joints and sawing it later is not permitted.

Place and fasten screed rails in position to ensure finishing the new surface to the required profile. Do not treat screed rails with parting compound to facilitate their removal. Prior to placing the overlay, attach a 2 inch filler block to the bottom of the screed and pass it over the area to be repaired to check the thickness. Remove all concrete that the block does not clear.

Separate screed rails or construction dams from the newly placed material by passing a pointing trowel along their inside face. Carefully make this trowel cut for the entire depth and length of rails or dams after the modified composition has sufficiently stiffened and cannot flow back.

Brush a latex cement mixture onto the wetted, prepared surface. Carefully give all vertical and horizontal surfaces a thorough, even coating and do not let the brushed material dry before it is covered with the additional material required for the final grade.

Remove all loose aggregate from the latex cement brushed surface prior to latex concrete placement (NOTE: Not required for surfaces prepared with hydro-demolition).

Place the latex modified concrete in one operation.

Provide a minimum overlay thickness of as shown in the plans and a final surface that is approximately the same as the original deck surface.

Construction joints other than those shown on the plans will be submitted to the Engineer for approval.

When a tight, uniform surface is achieved and before the concrete becomes non-plastic, further finish the surface of the floor by burlap dragging or another acceptable method that produces an acceptable uniform surface texture.

Promptly cover the surface with a single layer of clean, wet burlap as soon as the surface will support it without deformation. Wet cure only the surface for minimum 3 hours and until a compressive strength of 3000 psi is reached. Keep the curing material saturated during the wet cure period.

Field Testing Latex Modified Concrete-Very Early Strength

For projects with multiple bridges using the same mix design, or bridge decks with time constraints that require more than one night for placement, a relationship between the compressive strength and rebound hammer readings may be developed and used to obtain the three hour cylinder strength, in lieu of compressive strength testing. For the correct procedure, reference Document: PL11-LMC Rapid Set Overlays. Contact your

local M&T representative for a copy of this document or see the following link: <http://www.ncdot.org/doh/operations/materials/eforms.html> under Physical Lab. Seven day concrete compressive strength sampling and testing is required in addition to the use of this method.

Do not place the latex modified concrete before the burlap is saturated and approved by the Engineer. Drain excess water from the wet burlap before placement.

As soon as practical, after the concrete has hardened sufficiently, test the finished surface with an approved rolling straightedge that is designed, constructed, and adjusted so that it will accurately indicate or mark all floor areas which deviate from a plane surface by more than 1/8 inch in 10 feet (3 mm in 3 m). Remove all high areas in the hardened surface in excess of 1/8 inch in 10 feet (3 mm in 3 m) with an approved grinding or cutting machine. Where variations are such that the corrections extend below the limits of the top layer of grout, seal the corrected surface with an approved sealing agent if required by the Engineer. If approved by the Engineer, correct low areas in an acceptable manner.

Vehicular traffic may travel across an un-grooved deck, however, complete the transverse sawed grooves across the entire deck area after the latex modified concrete achieves design strength and no later than seven days after placing the latex modified concrete.

- C. Limitations of Operations: The mixer will not be permitted on the bridge deck unless otherwise approved.

No traffic is permitted on the finished latex modified concrete surface until the total specified curing time is completed and until the concrete reaches the minimum specified compressive strength.

Do not place latex modified concrete if the temperature of the concrete surface on which the overlay is to be placed is below 40°F (4°C) or above 85°F (29°C). Measure the surface temperature by placing a thermometer under the insulation against the surface.

Prior to placing latex modified concrete, the Engineer determines the air temperature and wind speed. Do not place latex modified concrete if the ambient air temperature is below 45°F (7°C) or above 85°F (29°C), or if the wind velocity is in excess of 10 mph (16 km/h). If working at night, provide approved lighting. Provide aggregates for use in the latex modified concrete that are free from ice, frost and frozen particles when introduced into the mixer.

Do not place latex modified concrete when the temperature of the latex modified concrete is below 45°F (7°C) or above 85°F (29°C).

If the rate of evaporation of surface moisture from the latex modified concrete exceeds 0.05 pounds per square foot per hour during placement, measures shall be taken to reduce the rate of evaporation. The evaporation rate is calculated using the following formula:

$$E = (T_c^{2.5} - rT_a^{2.5})(1 + 0.4V)(10^{-6}) \text{ where,}$$

E=Evaporation Rate, T_c=Concrete Temp (°F), r=Relative Humidity (%/100)
T_a=Air Temp (°F), V=Wind Velocity (mph)

Stop all placement operations during periods of precipitation. Take adequate precautions to protect freshly placed latex modified concrete from sudden or unexpected precipitation. Keep an adequate quantity of protective coverings at the worksite to protect the freshly placed pavement from precipitation.

5.0 MEASUREMENT AND PAYMENT

Latex Modified Concrete Overlay-Very Early Strength will be measured and paid for in cubic yards of latex modified concrete satisfactorily placed in the completed deck.

Placing and Finishing of Latex Modified Concrete Overlay-Very Early Strength will be paid for at the contract unit price bid per square yard which price will be full compensation for furnishing all labor, materials, tools, equipment and incidentals required to complete the work in accordance with the contract documents.

Grooving Bridge Floors will be measured and paid for in accordance with Section 420 of the *Standard Specifications*.

Payment will be made under:

Pay Item	Pay Unit
Latex Modified Concrete Overlay-Very Early Strength	Cubic Yard
Placing and Finishing Latex Modified Concrete Overlay-Very Early Strength	Square Yard

LATEX MODIFIED CONCRETE

(SPECIAL)

DESCRIPTION

This work consists of furnishing and placing an overlay of latex modified concrete (LMC) over conventional existing concrete or repair concrete on bridge decks and approach pavement. Unless otherwise indicated on the plans, groove the bridge floor in accordance with Subarticle 420-14(B) of the *Standard Specifications*.

Materials

For equipment, proportioning and mixing of modified compositions, see Section 1000-8 of the *Standard Specifications*. Prior to beginning any work, obtain approval for all equipment to be used for deck preparation, mixing, placing, finishing, and curing the latex modified concrete.

For material of modified compositions, see Section 1000-8 of the *Standard Specifications* with the following modifications:

Page 10-8, Subarticle 1000-7(A), lines 24-25, replace the last paragraph with the following:

Submit the latex modified concrete mix design, including laboratory compressive strength data for a minimum of six 4-inch by 8-inch cylinders at the appropriate age (7 days for normal setting concrete; 3 hours for very early strength concrete) to the Engineer for review. Include test results for the slump and air content of the laboratory mix. Perform tests in accordance with AASHTO T 22, T 119 and T 152.

PREPARATION OF SURFACE

Completely clean all surfaces within the 48 hours prior to placing the overlay unless otherwise approved.

Thoroughly soak the clean surface for at least 12 hours immediately prior to placing the latex modified concrete. After soaking the surface for at least 12 hours, cover it with a layer of white opaque polyethylene film that is at least 4 mils (0.100 mm) thick. Immediately prior to placing the latex modified concrete, remove standing water from the surface.

PLACING AND FINISHING

Prior to placing modified material, install a bulkhead of easily compressible material at expansion joints to the required grade and profile. Placing material across expansion joints and sawing it later is not permitted.

Place and fasten screed rails in position to ensure finishing the new surface to the required profile. Do not treat screed rails with parting compound to facilitate their removal. Prior to placing the overlay attach a filler block to the bottom of the screed and pass it over the area to be repaired to check the thickness. The filler block thickness shall be equal to the design overlay thickness as shown in the plans. Remove all concrete that the block does not clear.

Separate screed rails or construction dams from the newly placed material by passing a pointing trowel along their inside face. Carefully make this trowel cut for the entire depth and length of rails or dams after the modified composition has sufficiently stiffened and cannot flow back.

Brush a latex cement mixture onto the wetted, prepared surface. Carefully give all vertical and horizontal surfaces a thorough, even coating and do not let the brushed material dry before it is covered with the additional material required for the final grade. Remove all loose aggregate from the latex cement brushed surface prior to latex concrete placement (NOTE: Not required for surfaces prepared with hydro-demolition).

Place the latex modified concrete in one operation.

Provide a minimum overlay thickness as shown in the plans and a final surface that is approximately the same as the original deck surface.

Construction joints other than those shown on the plans will not be permitted unless approved by the Engineer.

When a tight, uniform surface is achieved and before the concrete becomes non-plastic, further finish the surface of the floor by burlap dragging or another acceptable method that produces an acceptable uniform surface texture.

Do not allow more than 15 feet (4.5 m) of exposed latex concrete behind the screed. In the event of a delay of 10 minutes or more, temporarily cover all exposed latex concrete with wet burlap and white opaque polyethylene. As soon as the surface supports burlap without deformations, cover the surface with a single layer of clean, wet burlap.

Do not place the latex modified concrete before the burlap is saturated and approved by the Engineer. Drain excess water from the wet burlap before placement.

Within 1 hour of covering with wet burlap, place a layer of 4 mil (0.100 mm) white opaque polyethylene film on the wet burlap and cure the surface for 48 hours. Then remove the curing material for an additional 96 hours air cure.

As soon as practical, after the concrete has hardened sufficiently, test the finished surface with an approved rolling straightedge that is designed, constructed, and adjusted so that it will accurately indicate or mark all floor areas which deviate from a plane surface by more than 1/8 inch in 10 feet (3 mm in 3 m). Remove all high areas in the hardened surface in excess of 1/8 inch in 10 feet (3 mm in 3 m) with an approved grinding or cutting machine. Where variations are such that the corrections extend below the limits of the top layer of grout, seal the corrected surface with an approved sealing agent if required by the Engineer. If approved by the Engineer, correct low areas in an acceptable manner.

Groove the bridge deck unless otherwise shown in the plans.

LIMITATIONS OF OPERATIONS

The mixer will not be permitted on the bridge deck unless otherwise approved.

No traffic is permitted on the finished latex modified concrete surface until the total specified curing time is completed and until the concrete reaches the minimum specified compressive strength.

Do not place latex modified concrete if the temperature of the concrete surface on which the overlay is to be placed is below 40°F (4°C) or above 85°F (29°C). Measure the surface temperature by placing a thermometer under the insulation against the surface.

Prior to placing latex modified concrete, the Engineer determines the air temperature and wind speed. Do not place latex modified concrete if the ambient air temperature is below 45°F (7°C) or above 85°F (29°C), or if the wind velocity is in excess of 10 mph (16 km/h). If working at night, provide approved lighting. Provide aggregates for use in the latex modified concrete that are free from ice, frost and frozen particles when introduced into the mixer.

Do not place latex modified concrete when the temperature of the latex modified concrete is below 45°F (7°C) or above 85°F (29°C).

If the rate of evaporation of surface moisture from the latex modified concrete exceeds 0.05 pounds per square foot per hour during placement, measures shall be taken to reduce the rate of evaporation. The evaporation rate is calculated using the following formula:

$$E=(T_c^{2.5}-rT_a^{2.5})(1+0.4V)(10^{-6}) \text{ where,}$$

E=Evaporation Rate, T_c =Concrete Temp ($^{\circ}$ F), r =Relative Humidity (%/100)

T_a =Air Temp ($^{\circ}$ F), V =Wind Velocity (mph)

Do not place latex modified concrete if the National Weather Service predicts the air temperature at the site to be below 35°F (2°C) during the next 72 hours. If this predicted air temperature is above 35°F (2°C) but below 50°F (10°C), then use insulation to protect the latex modified concrete for a period of at least 48 hours. Use insulation that meets the requirements of Subarticle 420-7(C) and, if required, place it on the latex modified concrete as soon as initial set permits. When using insulation to protect latex modified concrete during the wet curing period, do not remove the insulation until the ambient air temperature is at least 40°F (4°C) and rising. Leave the latex modified concrete uncovered for the 96 hour air curing period.

Assume all risks connected with the placement of latex modified concrete under cold weather conditions referred to above.

Stop all placement operations during periods of precipitation. Take adequate precautions to protect freshly placed latex modified concrete from sudden or unexpected precipitation. Keep an

adequate quantity of protective coverings at the worksite to protect the freshly placed pavement from precipitation.

MEASUREMENT AND PAYMENT

Latex Modified Concrete Overlay will be measured and paid for in cubic yards of latex modified concrete satisfactorily placed in the completed deck.

Placing and Finishing Latex Modified Concrete will be paid for at the contract unit price bid per square yard which price will be full compensation for furnishing all labor, materials, tools, equipment and incidentals required to complete the work in accordance with the contract documents.

Grooving Bridge Floors will be measured and paid in accordance with Section 420 of the *Standard Specifications*.

Payment will be made under:

Pay Item	Pay Unit
Latex Modified Concrete Overlay	Cubic Yard
Placing and Finishing Latex Modified Concrete Overlay	Square Yard

FOAM JOINT SEALS

(9-30-11)

1.0 SEALS

Use preformed seals compatible with concrete and resistant to abrasion, oxidation, oils, gasoline, salt and other materials that are spilled on or applied to the surface. Use a resilient, UV stable, preformed, impermeable, flexible, expansion joint seal. The joint seal shall consist of low-density, closed cell, cross-linked polyethylene non-extrudable, foam. The joint seal shall contain no EVA (Ethylene Vinyl Acetate). Cell generation shall be achieved by being physically blown using nitrogen. No chemical blowing agents shall be used in the cell generation process.

Use seals manufactured with grooves $1/8'' \pm$ wide by $1/8'' \pm$ deep and spaced between $1/4''$ and $1/2''$ apart along the bond surface running the length of the joint. Use seals with a depth that meets the manufacturer's recommendation, but is not less than 70% of the uncompressed width. Provide a seal designed so that, when compressed, the center portion of the top does not extend upward above the original height of the seal by more than $1/4''$. Provide a seal that has a working range of 30% tension and 60% compression and meets the requirements given below.

TEST	TEST METHOD	REQUIREMENT
Tensile strength	ASTM D3575-08, Suffix T	110 – 130 psi
Compression Set	ASTM D1056 Suffix B, 2 hr recovery	10% - 16%
Water Absorption	ASTM D3575	< 0.03 lb/ft ²
Elongation at Break	ASTM D3575	180% - 210%
Tear Strength	ASTM D624 (D3575-08, Suffix G)	14 – 20 pli
Density	ASTM D3575-08, Suffix W, Method A	1.8 – 2.2 lb/ft ³
Toxicity	ISO-10993.5	Pass (not cytotoxic)

Have the top of the joint seal clearly shop marked. Inspect the joint seals upon receipt to ensure that the marks are clearly visible before installation.

2.0 BONDING ADHESIVE

Use a two component, 100% solid, modified epoxy adhesive supplied by the joint seal manufacturer that meets the requirements given below.

TEST	TEST METHOD	REQUIREMENT
Tensile strength	ASTM D638	3000 psi (min.)
Compressive strength	ASTM D695	7000 psi (min.)
Hardness	Shore D Scale	75-85 psi
Water Absorption	ASTM D570	0.25% by weight max.
Elongation to Break	ASTM D638	5% (max.)
Bond Strength	ASTM C882	2000 psi (min.)

Use an adhesive that is workable to 40°F. When installing in ambient air or surface temperatures below 40°F or for application on moist, difficult to dry concrete surfaces, use an adhesive specified by the manufacturer of the joint seal.

3.0 ELASTOMERIC CONCRETE

The elastomeric concrete shall not be placed until the reinforced concrete deck slab has cured for seven full days and reached a minimum strength of 3000 psi.

Prepare the concrete surface within 48 hours prior to placing the elastomeric concrete. Before placing the elastomeric concrete, all concrete surfaces shall be thoroughly cleaned and dry. Sandblast the concrete surface in the blockout and clear the surface of all loose debris. Do not place the elastomeric concrete until the surface preparation is completed and approved.

A manufacturer's representative shall be present when placing elastomeric concrete. Do not place elastomeric concrete if the ambient air or surface temperature is below 45°F.

Prepare and apply a primer, as per manufacturer's recommendations, to all vertical concrete faces to be in contact with elastomeric concrete, and to areas specified by the manufacturer.

Prepare, batch, and place the elastomeric concrete in accordance with the manufacturer's instructions. Place the elastomeric concrete in the areas specified on the plans while the primer is still tacky and within 2 hours after applying the primer. Trowel the elastomeric concrete to a smooth finish.

4.0 SAWING THE JOINT

The joint opening shall be initially formed to the width shown on the plans including the blockout for the elastomeric concrete.

The elastomeric concrete shall cure a minimum of 2 days prior to sawing the elastomeric concrete to the final width and depth as specified in the plans.

When sawing the joint to receive the foam seal, always use a rigid guide to control the saw in the desired direction. To control the saw and to produce a straight line as indicated on the plans, anchor and positively connect a template or a track to the bridge deck. Do not saw the joint by visual means such as a chalk line. Fill the holes used for holding the template or track to the deck with an approved, flowable non-shrink, non-metallic grout.

Saw cut to the desired width and depth in one or two passes of the saw by placing and spacing two metal blades on the saw shaft to the desired width for the joint opening.

The desired depth is the depth of the seal plus 1/4" above the top of the seal plus approximately 1" below the bottom of the seal. An irregular bottom of sawed joint is permitted as indicated on the plans. Grind exposed corners on saw cut edges to a 1/4" chamfer.

Saw cut a straight joint, centered over the formed opening and to the desired width specified in the plans. Prevent any chipping or damage to the sawed edges of the joint.

Remove any staining or deposited material resulting from sawing with a wet blade to the satisfaction of the Engineer.

5.0 PREPARATION OF SAWED JOINT FOR SEAL INSTALLATION

After sawing the joint, the Engineer will thoroughly inspect the sawed joint opening for spalls, popouts, cracks, etc. All necessary repairs will be made by the Contractor prior to blast cleaning and installing the seal.

Clean the joints by sandblasting with clean dry sand immediately before placing the bonding agent. Sandblast the joint opening to provide a firm, clean joint surface free of curing compound, loose material and any foreign matter. Sandblast the joint opening without causing pitting or uneven surfaces. The aggregate in the elastomeric concrete may be exposed after sandblasting.

After blasting, either brush the surface with clean brushes made of hair, bristle or fiber, blow the surface with compressed air, or vacuum the surface until all traces of blast products and abrasives are removed from the surface, pockets, and corners.

If nozzle blasting is used to clean the joint opening, use compressed air that does not contain detrimental amounts of water or oil.

Examine the blast cleaned surface and remove any traces of oil, grease or smudge deposited in the cleaning operations.

Bond the seal to the blast cleaned surface on the same day the surface is blast cleaned.

6.0 SEAL INSTALLATION

Install the joint seal according to the manufacturer's procedures and recommendations and as recommended below. Do not install the joint seal if the ambient air or surface temperature is below 45°F. Have a manufacturer's certified trained factory representative present during the installation of the first seal of the project.

Before installing the joint seal, check the uninstalled seal length to insure the seal is the same length as the deck opening. When the joint seal requires splicing, use the heat welding method by placing the joint material ends against a teflon heating iron of 425-475°F for 7 - 10 seconds, then pressing the ends together tightly. Do not test the welding until the material has completely cooled.

Begin installation by protecting the top edges of the concrete deck adjacent to the vertical walls of the joint as a means to minimize clean up. After opening both cans of the bonding agent, stir each can using separate stirring rods for each component to prevent premature curing of the bonding agent. Pour the two components, at the specified mixing ratio, into a clean mixing bucket. Mix the components with a low speed drill (400 rpm max.) until a uniform gray color is achieved without visible marbling. Apply bonding agent to both sides of the elastomeric concrete as well as both sides of the joint seal, making certain to completely fill the grooves with epoxy. With gloved hands, compress the joint seal and with the help of a blunt probe, push the seal into the joint opening until the seal is recessed approximately 1/4" below the surface. When pushing down on the joint seal, apply pressure only in a downward direction. Do not push the joint seal into the joint opening at an angle that would stretch the material. Seals that are stretched during installation shall be removed and rejected. Once work on placing a seal begins, do not stop until it is completed. Clean the excess epoxy from the top of the joint seal immediately with a trowel. Do not use solvents or any cleaners to remove the excess epoxy from the top of the seal. Remove the protective cover at the joint edges and check for any excess epoxy on the surface. Remove excess epoxy with a trowel, the use of solvents or any cleaners will not be allowed.

The installed system shall be watertight and will be monitored until final inspection and approval. Do not place pavement markings on top of foam joint seals.

7.0 BASIS OF PAYMENT

Payment for all foam joint seals will be at the lump sum contract price bid for "Foam Joint Seals". Prices and payment will be full compensation for furnishing all material, including elastomeric concrete, labor, tools and equipment necessary for installing these units in place and accepted.

ELASTOMERIC CONCRETE

(9-30-11)

1.0 DESCRIPTION

Elastomeric concrete is a mixture of a two-part polymer consisting of polyurethane and/or epoxy and kiln-dried aggregate. Provide an elastomeric concrete and binder system that is preapproved. Use the concrete in the blocked out areas on both sides of the bridge deck joints as indicated on the plans.

2.0 MATERIALS

Provide materials that comply with the following minimum requirements at 14 days (or at the end of the specified curing time).

ELASTOMERIC PROPERTIES	CONCRETE	TEST METHOD	MINIMUM REQUIREMENT
Compressive Strength, psi		ASTM D695	2000
5% Deflection Resilience		ASTM D695	95
Splitting Tensile Strength, psi		ASTM D3967	625
Bond Strength to Concrete, psi		ASTM D882 (D882M)	450
Durometer Hardness		ASTM D2240	50

BINDER (without aggregate)	PROPERTIES	TEST METHOD	MINIMUM REQUIREMENT
	Tensile Strength, psi	ASTM D638	1000
	Ultimate Elongation	ASTM D638	150%
	Tear Resistance, lb/in	ASTM D624	200

In addition to the requirements above, the elastomeric concrete must be resistant to water, chemical, UV and ozone exposure and withstand temperature extremes. Elastomeric concrete systems requiring preheated aggregates are not allowed.

3.0 PREQUALIFICATION

Manufacturers of elastomeric concrete materials shall submit samples (including aggregate, primer and binder materials) and a Type 4 certification in accordance with Article 106-3 of the Standard Specifications for prequalification to:

North Carolina Department of Transportation
Materials and Tests Unit
1801 Blue Ridge Road
Raleigh, NC 27607

Prequalification will be determined for the system. Individual components will not be evaluated, nor will individual components of previously evaluated systems be deemed prequalified for use.

The submitted binder (a minimum volume of 1 gallon) and corresponding aggregate samples will be evaluated for compliance with the Materials requirements specified above. Systems satisfying all of the Materials requirements will be prequalified for a one year period. Before the end of this period new product samples shall be resubmitted for prequalification evaluation.

If, at any time, any formulation or component modifications are made to a prequalified system that system will no longer be approved for use.

4.0 MATERIAL CERTIFICATION AND INSTALLATION

Provide a Type 5 certification in accordance with Article 106-3 of the Standard Specifications, verifying that the materials satisfy the above requirements and proof of NCDOT prequalification.

Prior to placing the elastomeric concrete, thoroughly clean and dry all concrete surfaces. Sandblast the concrete surface in the blockout and clear the surface of all loose debris.

Provide a manufacturer's representative at the bridge site during the installation of the elastomeric concrete to ensure that all steps being performed comply with all manufacturer installation requirements including, but not limited to weather conditions (ambient temperature, relative humidity, precipitation, wind, etc), concrete deck surface preparation, binder and aggregate mixing, primer application, elastomeric concrete placement, curing conditions and minimum curing time before joint exposure to traffic.

5.0 FIELD SAMPLING

Provide additional production material to allow freshly mixed elastomeric concrete to be sampled for acceptance. A minimum of six 2 inch cube molds and three 3x6 inch cylinders will be taken by the Department for each day's production. Compression, splitting tensile, and durometer hardness testing will be performed by the Department to determine acceptance. Materials failing to meet the requirements listed above are subject to removal and replacement at no cost to the Department.

6.0 BASIS OF PAYMENT

No separate payment will be made for elastomeric concrete. The lump sum contract price bid for "Foam Joint Seals" will be full compensation for furnishing and placing the Elastomeric Concrete.

EPOXY RESIN INJECTION

(9-30-11)

1.0 GENERAL

For repairing cracks, an approved applicator is required to perform the epoxy resin injection. Make certain the supervisor and the workmen have completed an instruction program in the methods of restoring concrete structures utilizing the epoxy injection process and have a record of satisfactory performance on similar projects.

The applicator furnishes all materials, tools, equipment, appliances, labor and supervision required when repairing cracks with the injection of an epoxy resin adhesive.

2.0 SCOPE OF WORK

Using Epoxy Resin Injection, repair all cracks 5 mils (125 μm) wide or greater in the interior bent columns, caps, abutment caps and backwalls.

Repair the column cracks to the top of the ground line.

Repair any crack, void, honeycomb or spall area unsuitable for repair by injection with epoxy mortar.

3.0 COOPERATION

Cooperate and coordinate with the Technical Representative of the epoxy resin manufacturer for satisfactory performance of the work.

Have the Technical Representative present when the job begins and until the Engineer is assured that his service is no longer needed.

The expense of having this representative on the job is the Contractor's responsibility and no direct payment will be made for this expense.

The North Carolina Department of Transportation Material and Tests Unit obtains test cores from the repaired concrete. If the failure plane is located at the repaired crack, a minimum compressive strength of 3000 psi is required of these cores.

5.0 MATERIAL PROPERTIES

Provide a two-component structural epoxy adhesive for injection into cracks or other voids. Provide modified epoxy resin (Component "A") that conforms to the following requirements:

	Test Method	Specification Requirements
Viscosity @ 40 ± 3°F, cps	Brookfield RVT Spindle No. 4 @ 20 rpm	6000 - 8000
Viscosity @ 77 ± 3°F, cps	Brookfield RVT Spindle No. 2 @ 20 rpm	400 - 700
Epoxide Equivalent Weight	ASTM D1652	152 - 168
Ash Content, %	ASTM D482	1 max.

Provide the amine curing agent (Component "B") used with the epoxy resin that meets the following requirements:

	Test Method	Specification Requirements
Viscosity @ 40 ± 3°F, cps	Brookfield RVT Spindle No. 2 @ 20 rpm	700 - 1400
Viscosity @ 77 ± 3°F, cps	Brookfield RVT Spindle No. 2 @ 20 rpm	105 - 240
Amine Value, mg KOH/g	ASTM D664*	490 - 560
Ash Content, %	ASTM D482	1 max.
* Method modified to use perchloric acid in acetic acid.		

Certify that the Uncured Adhesive, when mixed in the mix ratio that the material supplier specifies, has the following properties:

Pot Life (60 gram mass)
 @ 77 ± 3°F - 15 minutes minimum
 @ 100 ± 3°F - 5 minutes minimum

Certify that the Adhesive, when cured for 7 days at 77 ± 3°F unless otherwise specified, has the following properties:

	Test Method	Specification Requirements
Ultimate Tensile Strength	ASTM D638	7000 psi (min.)
Tensile Elongation at Break	ASTM D638	4% max.
Flexural Strength	ASTM D790	10,000 psi (min.)

Flexural Modulus	ASTM D790	3.5×10^5 psi
Compressive Yield Strength	ASTM D695	11,000 psi (min.)
Compressive Modulus	ASTM D695	$2.0 - 3.5 \times 10^5$ psi
Heat Deflection Temperature Cured 28 days @ $77 \pm 3^\circ\text{F}$	ASTM D648*	125°F min. 135°F min.
Slant Shear Strength, 5000 psi (34.5 MPa) compressive strength concrete Cured 3 days @ 40°F wet concrete Cured 7 days @ 40°F wet concrete Cured 1 day @ 77°F dry concrete	AASHTO T237	 3500 psi (min.) 4000 psi (min.) 5000 psi (min.)
* Cure test specimens so that the peak exothermic temperature of the adhesive does not exceed 77°F .		

Use an epoxy bonding agent, as specified for epoxy mortar, as the surface seal (used to confine the epoxy resin during injection).

6.0 EQUIPMENT FOR INJECTION

Use portable positive displacement type pumps with interlock to provide positive ratio control of exact proportions of the two components at the nozzle to meter and mix the two injection adhesive components and inject the mixed adhesive into the crack. Use electric or air powered pumps that provide in-line metering and mixing.

Use injection equipment with automatic pressure control capable of discharging the mixed adhesive at any pre-set pressure up to 200 ± 5 psi and equipped with a manual pressure control override.

Use equipment capable of maintaining the volume ratio for the injection adhesive as prescribed by the manufacturer. A tolerance of $\pm 5\%$ by volume at any discharge pressure up to 200 psi is permitted.

Provide injection equipment with sensors on both the Component A and B reservoirs that automatically stop the machine when only one component is being pumped to the mixing head.

7.0 PREPARATION

Follow these steps prior to injecting the epoxy resin:

Remove all dirt, dust, grease, oil, efflorescence and other foreign matter detrimental to the bond of epoxy injection surface seal system from the surfaces adjacent to the cracks of other areas of application. Acids and corrosives are not permitted.

Provide entry ports along the crack at intervals not less than the thickness of the concrete at that location.

Apply surface seal material to the face of the crack between the entry ports. For through cracks, apply surface seal to both faces.

Allow enough time for the surface seal material to gain adequate strength before proceeding with the inspection.

8.0 EPOXY INJECTION

Begin epoxy adhesive injection in vertical cracks at the lower entry port and continue until the epoxy adhesive appears at the next higher entry port adjacent to the entry port being pumped.

Begin epoxy adhesive injection in horizontal cracks at one end of the crack and continue as long as the injection equipment meter indicates adhesive is being dispensed or until adhesive shows at the next entry port.

When epoxy adhesive appears at the next adjacent port, stop the current injection and transfer the epoxy injection to the next adjacent port where epoxy adhesive appeared.

Perform epoxy adhesive injection continuously until cracks are completely filled.

If port to port travel of epoxy adhesive is not indicated, immediately stop the work and notify the Engineer.

9.0 FINISHING

When cracks are completely filled, allow the epoxy adhesive to cure for sufficient time to allow the removal of the surface seal without any draining or runback of epoxy material from the cracks.

Remove the surface seal material and injection adhesive runs or spills from concrete surfaces.

Finish the face of the crack flush to the adjacent concrete, removing any indentations or protrusions caused by the placement of entry ports.

10.0 BASIS OF PAYMENT

Payment for epoxy resin injection will be at the contract unit price per linear foot for "Epoxy Resin Injection". Such payment will be full compensation for all materials, tools, equipment, labor, and for all incidentals necessary to complete the work.

SUBMITTAL OF WORKING DRAWINGS

(9-30-11)

1.0 GENERAL

Submit working drawings in accordance with Article 105-2 of the *Standard Specifications* and this provision. For this provision, "submittals" refers to only those listed in this provision. The list of submittals contained herein does not represent a list of required submittals for the project. Submittals are only necessary for those items as required by the contract. Make submittals that are not specifically noted in this provision directly to the

Resident Engineer. Either the Structure Design Unit or the Geotechnical Engineering Unit or both units will jointly review submittals.

If a submittal contains variations from plan details or specifications or significantly affects project cost, field construction or operations, discuss the submittal with and submit all copies to the Resident Engineer. State the reason for the proposed variation in the submittal. To minimize review time, make sure all submittals are complete when initially submitted. Provide a contact name and information with each submittal. Direct any questions regarding submittal requirements to the Resident Engineer, Structure Design Unit contacts or the Geotechnical Engineering Unit contacts noted below.

In order to facilitate in-plant inspection by NCDOT and approval of working drawings, provide the name, address and telephone number of the facility where fabrication will actually be done if different than shown on the title block of the submitted working drawings. This includes, but is not limited to, precast concrete items, prestressed concrete items and fabricated steel or aluminum items.

2.0 ADDRESSES AND CONTACTS

For submittals to the Structure Design Unit, use the following addresses:

Via US mail:

Mr. G. R. Perfetti, P. E.
State Bridge Design Engineer
North Carolina Department
of Transportation
Structure Design Unit
1581 Mail Service Center
Raleigh, NC 27699-1581

Attention: Mr. P. D. Lambert, P. E.

Via other delivery service:

Mr. G. R. Perfetti, P. E.
State Bridge Design Engineer
North Carolina Department
of Transportation
Structure Design Unit
1000 Birch Ridge Drive
Raleigh, NC 27610

Attention: Mr. P. D. Lambert, P. E.

Submittals may also be made via email.

Send submittals to:

plambert@ncdot.gov (Paul Lambert)

Send an additional e-copy of the submittal to the following address:

jgaither@ncdot.gov (James Gaither)

For submittals to the Geotechnical Engineering Unit, use the following addresses:

For projects in Divisions 1-7, use the following Eastern Regional Office address:

Via US mail:

Mr. K. J. Kim, Ph. D., P. E.
Eastern Regional Geotechnical
Manager
North Carolina Department
of Transportation
Geotechnical Engineering Unit
Eastern Regional Office
1570 Mail Service Center
Raleigh, NC 27699-1570

Via other delivery service:

Mr. K. J. Kim, Ph. D., P. E.
Eastern Regional Geotechnical
Manager
North Carolina Department
of Transportation
Geotechnical Engineering Unit
Eastern Regional Office
3301 Jones Sausage Road, Suite 100
Garner, NC 27529

For projects in Divisions 8-14, use the following Western Regional Office address:

Via US mail:

Mr. John Pilipchuk, L. G., P. E.
Western Regional Geotechnical
Manager
North Carolina Department
of Transportation
Geotechnical Engineering Unit
Western Regional Office
5253 Z Max Boulevard
Harrisburg, NC 28075

Via other delivery service:

Mr. John Pilipchuk, L. G., P. E.
Western Region Geotechnical
Manager
North Carolina Department
of Transportation
Geotechnical Engineering Unit
Western Regional Office
5253 Z Max Boulevard
Harrisburg, NC 28075

The status of the review of structure-related submittals sent to the Structure Design Unit can be viewed from the Unit's web site, via the "Contractor Submittal" link.

Direct any questions concerning submittal review status, review comments or drawing markups to the following contacts:

Primary Structures Contact:

Paul Lambert
(919) 707 – 6407
(919) 250 – 4082 facsimile
plambert@ncdot.gov

Secondary Structures Contacts:

James Gaither
(919) 707 – 6409

Eastern Regional Geotechnical Contact (Divisions 1-7):

K. J. Kim
(919) 662 – 4710
(919) 662 – 3095 facsimile
kkim@ncdot.gov

Western Regional Geotechnical Contact (Divisions 8-14):

John Pilipchuk
(704) 455 – 8902
(704) 455 – 8912 facsimile
jpilipchuk@ncdot.gov

3.0 SUBMITTAL COPIES

Furnish one complete copy of each submittal, including all attachments, to the Resident Engineer. At the same time, submit the number of hard copies shown below of the same complete submittal directly to the Structure Design Unit and/or the Geotechnical Engineering Unit.

The first table below covers "Structure Submittals". The Resident Engineer will receive review comments and drawing markups for these submittals from the Structure Design Unit. The second table in this section covers "Geotechnical Submittals". The Resident Engineer will receive review comments and drawing markups for these submittals from the Geotechnical Engineering Unit.

Unless otherwise required, submit one set of supporting calculations to either the Structure Design Unit or the Geotechnical Engineering Unit unless both units require submittal copies in which case submit a set of supporting calculations to each unit. Provide additional copies of any submittal as directed.

<u>STRUCTURE SUBMITTALS</u>			
Submittal	Copies Required by Structure Design Unit	Copies Required by Geotechnical Engineering Unit	Contract Reference Requiring Submittal ¹
Arch Culvert Falsework	5	0	Plan Note, SN Sheet & "Falsework and Formwork"
Box Culvert Falsework ⁷	5	0	Plan Note, SN Sheet & "Falsework and Formwork"
Cofferdams	6	2	Article 410-4
Foam Joint Seals ⁶	9	0	"Foam Joint Seals"
Expansion Joint Seals (hold down plate type with base angle)	9	0	"Expansion Joint Seals"
Expansion Joint Seals (modular)	2, then 9	0	"Modular Expansion Joint Seals"
Expansion Joint Seals (strip seals)	9	0	"Strip Seals"
Falsework & Forms ² (substructure)	8	0	Article 420-3 & "Falsework and Formwork"
Falsework & Forms (superstructure)	8	0	Article 420-3 & "Falsework and Formwork"
Girder Erection over Railroad	5	0	Railroad Provisions
Maintenance and Protection of Traffic Beneath Proposed Structure	8	0	"Maintenance and Protection of Traffic Beneath Proposed Structure at Station ____"
Metal Bridge Railing	8	0	Plan Note
Metal Stay-in-Place Forms	8	0	Article 420-3
Metalwork for Elastomeric Bearings ^{4,5}	7	0	Article 1072-8
Miscellaneous Metalwork ^{4,5}	7	0	Article 1072-8
Optional Disc Bearings ⁴	8	0	"Optional Disc Bearings"

Overhead and Digital Message Signs (DMS) (metalwork and foundations)	13	0	Applicable Provisions
Placement of Equipment on Structures (cranes, etc.)	7	0	Article 420-20
Pot Bearings ⁴	8	0	“Pot Bearings”
Precast Concrete Box Culverts	2, then 1 reproducible	0	“Optional Precast Reinforced Concrete Box Culvert at Station ____”
Prestressed Concrete Cored Slab (detensioning sequences) ³	6	0	Article 1078-11
Prestressed Concrete Deck Panels	6 and 1 reproducible	0	Article 420-3
Prestressed Concrete Girder (strand elongation and detensioning sequences)	6	0	Articles 1078-8 and 1078-11
Removal of Existing Structure over Railroad	5	0	Railroad Provisions
Revised Bridge Deck Plans (adaptation to prestressed deck panels)	2, then 1 reproducible	0	Article 420-3
Revised Bridge Deck Plans (adaptation to modular expansion joint seals)	2, then 1 reproducible	0	“Modular Expansion Joint Seals”
Sound Barrier Wall (precast items)	10	0	Article 1077-2 & “Sound Barrier Wall”
Sound Barrier Wall Steel Fabrication Plans ⁵	7	0	Article 1072-8 & “Sound Barrier Wall”
Structural Steel ⁴	2, then 7	0	Article 1072-8
Temporary Detour Structures	10	2	Article 400-3 & “Construction, Maintenance and Removal of Temporary Structure at Station ____”
TFE Expansion Bearings ⁴	8	0	Article 1072-8

FOOTNOTES

- References are provided to help locate the part of the contract where the submittals are required. References in quotes refer to the provision by that name. Articles refer to the *Standard Specifications*.

2. Submittals for these items are necessary only when required by a note on plans.
3. Submittals for these items may not be required. A list of pre-approved sequences is available from the producer or the Materials & Tests Unit.
4. The fabricator may submit these items directly to the Structure Design Unit.
5. The two sets of preliminary submittals required by Article 1072-8 of the *Standard Specifications* are not required for these items.
6. Submittals for Fabrication Drawings are not required. Submittals for Catalogue Cuts of Proposed Material are required. See Section 5.A of the referenced provision.
7. Submittals are necessary only when the top slab thickness is 18" or greater.

<u>GEOTECHNICAL SUBMITTALS</u>			
Submittal	Copies Required by Geotechnical Engineering Unit	Copies Required by Structure Design Unit	Contract Reference Requiring Submittal ¹
Drilled Pier Construction Plans ²	1	0	Subarticle 411-3(A)
Crosshole Sonic Logging (CSL) Reports ²	1	0	Subarticle 411-5(A)(2)
Pile Driving Equipment Data Forms ^{2,3}	1	0	Subarticle 450-3(D)(2)
Pile Driving Analyzer (PDA) Reports ²	1	0	Subarticle 450-3(F)(3)
Retaining Walls ⁴	8 drawings, 2 calculations	2 drawings	Applicable Provisions
Temporary Shoring ⁴	5 drawings, 2 calculations	2 drawings	“Temporary Shoring” & “Temporary Soil Nail Walls”

FOOTNOTES

1. References are provided to help locate the part of the contract where the submittals are required. References in quotes refer to the provision by that name. Subarticles refer to the *Standard Specifications*.
2. Submit one hard copy of submittal to the Resident or Bridge Maintenance Engineer. Submit a second copy of submittal electronically (PDF via email) or by facsimile, US mail or other delivery service to the appropriate Geotechnical Engineering Unit regional office. Electronic submission is preferred.

3. The Pile Driving Equipment Data Form is available from:

www.ncdot.org/doh/preconstruct/highway/geotech/formdet/

See second page of form for submittal instructions.

4. Electronic copy of submittal is required. See referenced provision.

FALSEWORK AND FORMWORK

(9-30-11)

4.0 DESCRIPTION

Use this Special Provision as a guide to develop temporary works submittals required by the Standard Specifications or other provisions; no additional submittals are required herein. Such temporary works include, but are not limited to, falsework and formwork.

Falsework is any temporary construction used to support the permanent structure until it becomes self-supporting. Formwork is the temporary structure or mold used to retain plastic or fluid concrete in its designated shape until it hardens. Access scaffolding is a temporary structure that functions as a work platform that supports construction personnel, materials, and tools, but is not intended to support the structure. Scaffolding systems that are used to temporarily support permanent structures (as opposed to functioning as work platforms) are considered to be falsework under the definitions given. Shoring is a component of falsework such as horizontal, vertical, or inclined support members. Where the term “temporary works” is used, it includes all of the temporary facilities used in bridge construction that do not become part of the permanent structure.

Design and construct safe and adequate temporary works that will support all loads imposed and provide the necessary rigidity to achieve the lines and grades shown on the plans in the final structure.

5.0 MATERIALS

Select materials suitable for temporary works; however, select materials that also ensure the safety and quality required by the design assumptions. The Engineer has authority to reject material on the basis of its condition, inappropriate use, safety, or nonconformance with the plans. Clearly identify allowable loads or stresses for all materials or manufactured devices on the plans. Revise the plan and notify the Engineer if any change to materials or material strengths is required.

6.0 DESIGN REQUIREMENTS

A. Working Drawings

Provide working drawings for items as specified in the contract, or as required by the Engineer, with design calculations and supporting data in sufficient detail to permit a structural and safety review of the proposed design of the temporary work.

On the drawings, show all information necessary to allow the design of any component to be checked independently as determined by the Engineer.

When concrete placement is involved, include data such as the drawings of proposed sequence, rate of placement, direction of placement, and location of all construction joints. Submit the number of copies as called for by the contract.

When required, have the drawings and calculations prepared under the guidance of, and sealed by, a North Carolina Registered Professional Engineer who is knowledgeable in temporary works design.

If requested by the Engineer, submit with the working drawings manufacturer's catalog data listing the weight of all construction equipment that will be supported on the temporary work. Show anticipated total settlements and/or deflections of falsework and forms on the working drawings. Include falsework footing settlements, joint take-up, and deflection of beams or girders. Falsework hangers that support concentrated loads and are installed at the edge of thin top flange concrete girders (such as bulb tee girders) shall be spaced so as not to exceed 75% of the manufacturer's stated safe working load. Use of dual leg hangers (such as Meadow Burke HF-42 and HF-43) are not allowed on concrete girders with thin top flanges. Design the falsework and forms supporting deck slabs and overhangs on girder bridges so that there will be no differential settlement between the girders and the deck forms during placement of deck concrete.

When staged construction of the bridge deck is required, detail falsework and forms for screed and fluid concrete loads to be independent of any previous deck pour components when the mid-span girder deflection due to deck weight is greater than $\frac{3}{4}$ ".

Note on the working drawings any anchorages, connectors, inserts, steel sleeves or other such devices used as part of the falsework or formwork that remains in the permanent structure. If the plan notes indicate that the structure contains the necessary corrosion protection required for a Corrosive Site, epoxy coat, galvanize or metalize these devices. Electroplating will not be allowed. Any coating required by the Engineer will be considered incidental to the various pay items requiring temporary works.

Design falsework and formwork requiring submittals in accordance with the 1995 AASHTO *Guide Design Specifications for Bridge Temporary Works* except as noted herein.

1. Wind Loads

Table 2.2 of Article 2.2.5.1 is modified to include wind velocities up to 110 mph. In addition, Table 2.2A is included to provide the maximum wind speeds by county in North Carolina.

Table 2.2 - Wind Pressure Values

Height Zone feet above ground	Pressure, lb/ft ² for Indicated Wind Velocity, mph				
	70	80	90	100	110
0 to 30	15	20	25	30	35
30 to 50	20	25	30	35	40
50 to 100	25	30	35	40	45
over 100	30	35	40	45	50

2. Time of Removal

The following requirements replace those of Article 3.4.8.2.

Do not remove forms until the concrete has attained strengths required in Article 420-16 of the Standard Specifications and these Special Provisions.

Do not remove forms until the concrete has sufficient strength to prevent damage to the surface.

Table 2.2A - Steady State Maximum Wind Speeds by Counties in North Carolina

COUNTY	25 YR (mph)	COUNTY	25 YR (mph)	COUNTY	25 YR (mph)
Alamance	70	Franklin	70	Pamlico	100
Alexander	70	Gaston	70	Pasquotank	100
Alleghany	70	Gates	90	Pender	100
Anson	70	Graham	80	Perquimans	100
Ashe	70	Granville	70	Person	70
Avery	70	Greene	80	Pitt	90
Beaufort	100	Guilford	70	Polk	80
Bertie	90	Halifax	80	Randolph	70
Bladen	90	Harnett	70	Richmond	70
Brunswick	100	Haywood	80	Robeson	80
Buncombe	80	Henderson	80	Rockingham	70
Burke	70	Hertford	90	Rowan	70
Cabarrus	70	Hoke	70	Rutherford	70
Caldwell	70	Hyde	110	Sampson	90
Camden	100	Iredell	70	Scotland	70
Carteret	110	Jackson	80	Stanley	70
Caswell	70	Johnston	80	Stokes	70
Catawba	70	Jones	100	Surry	70
Cherokee	80	Lee	70	Swain	80
Chatham	70	Lenoir	90	Transylvania	80
Chowan	90	Lincoln	70	Tyrell	100
Clay	80	Macon	80	Union	70
Cleveland	70	Madison	80	Vance	70
Columbus	90	Martin	90	Wake	70
Craven	100	McDowell	70	Warren	70
Cumberland	80	Mecklenburg	70	Washington	100
Currituck	100	Mitchell	70	Watauga	70
Dare	110	Montgomery	70	Wayne	80
Davidson	70	Moore	70	Wilkes	70
Davie	70	Nash	80	Wilson	80
Duplin	90	New Hanover	100	Yadkin	70
Durham	70	Northampton	80	Yancey	70
Edgecombe	80	Onslow	100		
Forsyth	70	Orange	70		

B. Review and Approval

The Engineer is responsible for the review and approval of temporary works' drawings.

Submit the working drawings sufficiently in advance of proposed use to allow for their review, revision (if needed), and approval without delay to the work.

The time period for review of the working drawings does not begin until complete drawings and design calculations, when required, are received by the Engineer.

Do not start construction of any temporary work for which working drawings are required until the drawings have been approved. Such approval does not relieve the Contractor of the responsibility for the accuracy and adequacy of the working drawings.

7.0 CONSTRUCTION REQUIREMENTS

All requirements of Section 420 of the Standard Specifications apply.

Construct temporary works in conformance with the approved working drawings. Ensure that the quality of materials and workmanship employed is consistent with that assumed in the design of the temporary works. Do not weld falsework members to any portion of the permanent structure unless approved. Show any welding to the permanent structure on the approved construction drawings.

Provide tell-tales attached to the forms and extending to the ground, or other means, for accurate measurement of falsework settlement. Make sure that the anticipated compressive settlement and/or deflection of falsework does not exceed 1 inch. For cast-in-place concrete structures, make sure that the calculated deflection of falsework flexural members does not exceed 1/240 of their span regardless of whether or not the deflection is compensated by camber strips.

A. Maintenance and Inspection

Inspect and maintain the temporary work in an acceptable condition throughout the period of its use. Certify that the manufactured devices have been maintained in a condition to allow them to safely carry their rated loads. Clearly mark each piece so that its capacity can be readily determined at the job site.

Perform an in-depth inspection of an applicable portion(s) of the temporary works, in the presence of the Engineer, not more than 24 hours prior to the beginning of each concrete placement. Inspect other temporary works at least once a month to ensure that they are functioning properly. Have a North Carolina Registered Professional Engineer inspect the cofferdams, shoring, sheathing, support of excavation structures, and support systems for load tests prior to loading.

B. Foundations

Determine the safe bearing capacity of the foundation material on which the supports for temporary works rest. If required by the Engineer, conduct load tests to verify proposed bearing capacity values that are marginal or in other high-risk situations.

The use of the foundation support values shown on the contract plans of the permanent structure is permitted if the foundations are on the same level and on the same soil as those of the permanent structure.

Allow for adequate site drainage or soil protection to prevent soil saturation and washout of the soil supporting the temporary works supports.

If piles are used, the estimation of capacities and later confirmation during construction using standard procedures based on the driving characteristics of the pile is permitted. If preferred, use load tests to confirm the estimated capacities; or, if required by the Engineer conduct load tests to verify bearing capacity values that are marginal or in other high risk situations.

The Engineer reviews and approves the proposed pile and soil bearing capacities.

8.0 REMOVAL

Unless otherwise permitted, remove and keep all temporary works upon completion of the work. Do not disturb or otherwise damage the finished work.

Remove temporary works in conformance with the contract documents. Remove them in such a manner as to permit the structure to uniformly and gradually take the stresses due to its own weight.

9.0 METHOD OF MEASUREMENT

Unless otherwise specified, temporary works will not be directly measured.

10.0 BASIS OF PAYMENT

Payment at the contract unit prices for the various pay items requiring temporary works will be full compensation for the above falsework and formwork.

CLEANING AND PAINTING EXISTING BEARING PLATES

(9-30-11)

Thoroughly clean the exposed surfaces of all bearing plates, anchor bolts, nuts and washers in the existing structure in accordance with the Article 442-7(B) of the Standard Specifications. Have the Engineer approve the cleaning of each unit before beginning painting.

After cleaning, apply a touch up coat of natural color organic zinc repair paint to the steel followed by a complete coat of the same paint.

Payment at the contract unit prices for the various pay items will be full compensation for the above work required for cleaning and painting existing bearing plates.

SHOTCRETE REPAIRS

(9-30-11)

1.0 GENERAL

The work covered by this Special Provision consists of removing deteriorated concrete from the structure in accordance with the limits, depth and details shown on the plans, described herein and as established by the Engineer. This work also includes removing and disposing all loose debris, cleaning and repairing reinforcing steel and applying shotcrete.

The location and extent of repairs shown on the plans are general in nature. The Engineer shall determine the extent of removal in the field based on an evaluation of the condition of the exposed surfaces.

Any portion of the structure that is damaged from construction operations shall be repaired to the Engineer's satisfaction, at no extra cost to the Department.

2.0 MATERIAL REQUIREMENTS PLATFORM

Use prepackaged shotcrete conforming to the requirements of ASTM C1480, the applicable sections of the Standard Specifications and the following:

Test Description	Test Method	Age (Days)	Specified Requirements
Silica Fume (%)	ASTM C1240	-	10 (Max.)
Water/Cementitious Materials Ratio	-	-	0.40 (Max.)
Air Content - As Shot (%)	ASTM C231	-	4 ± 1
Slump - As Shot (Range in inches)	ASTM C143	-	2 - 3
Minimum Compressive Strength (psi)	ASTM C39	7 28	3,000 5,000
Minimum Bond Pull-off Strength (psi)	ASTM C1583	28	145
Rapid Chloride Permeability Tests (range in coulombs)	ASTM C1202	-	100 - 1000

Admixtures are not allowed unless approved by the Engineer. Store shotcrete in an environment where temperatures remain above 40°F and less than 95°F.

All equipment must operate in accordance with the manufacturer's specifications and material must be placed within the recommended time.

3.0 QUALITY CONTROL

Qualification of Shotcrete Contractor

The shotcrete Contractor shall provide proof of experience by submitting a description of jobs similar in size and character that have been completed within the last 5 years. The name, address and telephone number of references for the submitted projects shall also be furnished. Failure to provide appropriate documentation will result in the rejection of the proposed shotcrete contractor.

Qualification of Nozzleman

The shotcrete Contractor's nozzleman shall be certified by the American Concrete Institute (ACI). Submit proof of certification to the Engineer prior to beginning repair work. The nozzleman shall maintain certification at all times while work is being performed for the Department. Failure to provide and maintain certification will result in the rejection of the proposed nozzleman.

4.0 TEMPORARY WORK PLATFORM

Prior to beginning any repair work, provide details for a sufficiently sized temporary work platform at each repair location. Design steel members to meet the requirements of the American Institute of Steel Construction Manual. Design timber members in accordance with the "National Design Specification for Stress-Grade Lumber and Its Fastenings" of the National Forest Products Association. Submit the platform design and plans for review and approval. The design and plans shall be sealed and signed by a North Carolina registered Professional Engineer. Do not install the platform until the design and plans are approved. Drilling holes in the superstructure for the purpose of attaching the platform is prohibited. Upon completion of work, remove all anchorages in the substructure and repair the substructure at no additional cost to the Department.

5.0 SURFACE PREPARATION

Prior to starting the repair operation, delineate all surfaces and areas assumed to be deteriorated by visually examining and sounding the concrete surface with a hammer or other approved method. The Engineer is the sole judge in determining the limits of deterioration.

Prior to removal, introduce a shallow saw cut approximately ½" in depth around the repair area at right angles to the concrete surface. Remove all deteriorated concrete to sound concrete with a 17 lb (maximum) pneumatic hammer with points that do not exceed the width of the shank or with hand picks or chisels as directed by the Engineer. Do not cut or remove the existing reinforcing steel. Unless specifically directed by the Engineer, do not remove concrete deeper than 1 inch below the reinforcing steel. If sound concrete is encountered before existing reinforcing steel is exposed, repair the surface without removing additional concrete. If any reinforcing steel is exposed remove the concrete to a minimum clearance of 1 inch around the reinforcing steel.

Abrasive blast all exposed concrete surfaces and existing reinforcing steel in repair areas to remove all debris, loose concrete, loose mortar, rust, scale, etc. Use a wire brush to clean all exposed reinforcing steel. After sandblasting examine the reinforcing steel to ensure at least 90% of the original diameter remains. If there is more than 10% reduction in the rebar diameter, splice in and securely tie supplemental reinforcing bars as directed by the Engineer.

Provide welded stainless wire fabric at each repair area larger than one square foot if the depth of the repair exceeds 2 inches from the "As Built" outside face. Provide a minimum 4" x 4" - 12 gage stainless welded wire fabric unless otherwise shown on the plans. Rigidly secure the welded wire fabric to existing steel or to 3/16" diameter stainless hook fasteners adequately spaced to prevent sagging. Encase the welded wire fabric in shotcrete a minimum depth of 1½ inches.

The contractor has the option to use synthetic fiber reinforcement as an alternate to welded wire fabric if attaching welded wire fabric is impractical or if approved by the Engineer. Welded wire fabric and synthetic fiber reinforcement shall not be used in the same repair area.

Thoroughly clean the repair area of all dirt, grease, oil or foreign matter, and remove all loose or weakened material before applying shotcrete. Saturate the repair area with clean water the day before applying shotcrete. Bring the wetted surface to a saturated surface dry (SSD) condition prior to applying shotcrete and maintain this condition until the application begins.

Use a blowpipe to facilitate removal of free surface water. Only oil-free compressed air is to be used in the blowpipe.

The time between removal of deteriorated concrete and applying shotcrete shall not exceed 5 days. If the time allowance exceeds 5 days, prepare the surface at the direction of the Engineer before applying shotcrete.

6.0 APPLICATION AND SURFACE FINISH

Apply shotcrete only when the surface temperature of the repair area is greater than 40°F and less than 95°F. Do not apply shotcrete to frosted surfaces. Maintain shotcrete at a minimum temperature of 40°F for 3 days after placement.

Apply shotcrete in layers. The properties of the applied shotcrete determine the proper thickness of each layer or lift.

The nozzleman should hold the nozzle 3 to 4 feet from the surface being covered in a position that ensures the shotcrete strikes at right angles to the surface being covered without excessive impact. The nozzleman shall maintain the water amount at a practicable minimum, so the mix properly adheres to the repair area. Water content should not become high enough to cause the mix to sag or fall from vertical or inclined surfaces, or to separate in horizontal layers.

Use shooting wires or guide strips that do not entrap rebound sand. Use guide wires to provide a positive means of checking the total thickness of the shotcrete applied. Remove the guide wires prior to the final finish coat.

To avoid leaving sand pockets in the shotcrete, blow or rake off sand that rebounds and does not fall clear of the work, or which collects in pockets in the work. Do not reuse rebound material in the work.

If a work stoppage longer than 2 hours takes place on any shotcrete layer prior to the time it has been built up to required thickness, saturate the area with clean water and use a blowpipe as outlined previously, prior to continuing with the remaining shotcrete course. Do not apply shotcrete to a dry surface.

Finish all repaired areas, including chamfered edges, as close as practicable to their original "As Built" dimensions and configuration. Provide a minimum 2" of cover for reinforcing steel exposed during repair. Slightly build up and trim shotcrete to the final surface by cutting with the leading edge of a sharp trowel. Use a rubber float to correct any imperfections. Limit work on the finished surface to correcting imperfections caused by trowel cutting.

Immediately after bringing shotcrete surfaces to final thickness, thoroughly check for sags, bridging, and other deficiencies. Repair any imperfections at the direction of the Engineer.

Prevent finished shotcrete from drying out by maintaining 95% relative humidity at the repair and surrounding areas by fogging, moist curing or other approved means for seven days.

7.0 MATERIAL TESTING & ACCEPTANCE

Each day shotcreting takes place, the nozzleman shall shoot one 18" x 18" x 3" test panel in the same position as the repair work that is being done to demonstrate the shotcrete is being applied properly. Store, handle and cure the test panel in the same manner as the repaired substructure.

Approximately 72 hours after completing the final shotcrete placement, thoroughly test the surface with a hammer. At this time, the repair area should have sufficient strength for all sound sections to ring sharply. Remove and replace any unsound portions prior to the final inspection of the work. No additional compensation will be provided for removal and replacement of unsound shotcrete.

After 7 days, core three 3" diameter samples from each test panel and from the repaired structure as directed by the Engineer. Any cores taken from the structure shall penetrate into the existing structure concrete at least 2 inches. Cores shall be inspected for delamination, sand pockets, tested for bond strength and compressive strength. If a core taken from a repaired structure unit indicates unsatisfactory application or performance of the shotcrete, take additional cores from the applicable structure unit(s) for additional evaluation and testing as directed by the Engineer. Any repair work failing to meet the requirements of this provision will be rejected and the Contractor shall implement a remediation plan to correct the deficiency at no additional cost to the Department. No extra payment will be provided for drilling extra cores. Patch all core holes in repaired structure units to the satisfaction of the Engineer. All material testing, core testing and sampling will be done by the Materials and Tests Unit of North Carolina Department of Transportation.

8.0 METHOD OF MEASUREMENT

Shotcrete will be measured in cubic feet of shotcrete required for repair. Depth will be measured from the original outside concrete surface. The Contractor and Engineer will measure quantities after removal of unsound concrete and before application of shotcrete.

9.0 BASIS OF PAYMENT

Repair work will be paid for at the contract unit price bid per cubic foot of "Shotcrete Repairs." Payment will be full compensation for removal, containment and disposal of unsound concrete including the cost of materials, labor, tools, equipment and incidentals necessary to complete the repair work. Payment will also include testing for soundness, curing of shotcrete and taking core samples from the test panels and substructure units.

TEMPORARY SUPPORTS

(SPECIAL)

SCOPE OF WORK

Temporary supports may be required, at the direction of the Engineer, to maintain the structural integrity of Bridge #213 during the "Shotcrete Repairs" to be performed on the existing substructure, girders, and bent diaphragms. They shall be installed at locations as approved by the Engineer where removal of the deteriorated concrete during "Surface Preparation" becomes extensive enough to warrant the need for additional support to maintain existing dead and live loads on the structure for the duration of time required to complete the repairs.

This work shall consist of furnishing all labor, equipment and materials to temporarily support the structure and removal of the system after repairs have been completed. The Contractor shall submit plans for Temporary Supports in locations as directed by the Engineer for approved prior to beginning work. The Contractor shall be responsible for determining the appropriate loads required to stabilize the structure while the repair work is being completed. Design of Temporary Supports shall be performed by a North Carolina Registered Professional Engineer. Any damage to the existing structure as a result of the Temporary Supports shall be the responsibility of the Contractor.

MEASUREMENT AND PAYMENT

Temporary Supports will be paid for at the Lump Sum Contract Price and will be full compensation for the design, installation, maintenance, and removal of the system.

Payment will be made under:

Pay Item	Pay Unit
Temporary Supports	Lump Sum

CONCRETE REPAIRS**(9-30-11)****DESCRIPTION**

Work includes removal of concrete in spalled, delaminated and/or cracked areas of the existing caps and columns in reasonably close conformity with the lines, depth, and details shown on the plans, described herein and as established by the Engineer. This work also includes straightening, cleaning, and replacement of reinforcing steel, dowelling new reinforcing steel, removing all loose materials, removing and disposing of debris, formwork, applying repair material, and protecting adjacent areas of the bridge and environment from material leakage. The repair material shall be one of the below described materials unless otherwise noted in the plans or provisions.

The location and extent of repairs shown on the plans described herein are general in nature. The Engineer determines the exact extent of removal in the field based on an evaluation of the condition of the exposed surfaces. The Contractor shall coordinate with the Engineer for removal operations such that repairs will not be implemented on more than one face of the concrete element without the approval of the engineer.

Repair, to the Engineer's satisfaction, any portion of the structure that is damaged from construction operations. No extra payment is provided for these repairs.

REPAIR MATERIAL OPTIONS**Polymer Modified Concrete Repair Material**

Repair material shall be polymer modified cement mortar for vertical or overhead applications and shall be suitable for applications in marine environments. Material shall be approved for use by NCDOT. Submit repair material to the Engineer for review and approval prior to beginning the work. Color of repair material shall be concrete gray.

Prior to the application of repair mortar, square up edges in repair areas, thoroughly clean surfaces to be repaired and remove all loose materials. Remove grease, wax, salt, and oil contaminants by scrubbing with an industrial grade detergent or degreasing compound followed by a mechanical cleaning. Remove weak or deteriorated concrete to sound concrete by bush hammering, gritblasting, scarifying, waterblasting, or other approved methods. Remove dirt, dust, laitance and curing compounds by gritblasting, sanding, or etching with 15% hydrochloric acid. Only acid etch if approved and follow it by scrubbing and flushing with copious amounts of clean water. Check the cleaning using moist pH paper. Water cleaning is complete when the paper reads 10 or higher. Follow all mechanical cleaning with vacuum cleaning.

When surface preparation is completed, mix and apply repair mortar in accordance with manufacturer's recommendations. Use aggregate that is washed, kiln-dried, and bagged. Apply bonding agent to all repair areas immediately prior to placing repair mortar. Repair areas shall be formed unless otherwise approved by the Engineer. Form areas to establish the original neat lines of the member being repaired.

Apply repair mortar to damp surfaces only when approved. In such instances, remove all free water by air-blasting. After applying the repair mortar, remove excessive material and provide a smooth, flush surface.

Class A Concrete Repair Material

Repair material shall be Class A Portland Cement Concrete as described in Section 1000 of the Standard Specifications.

Prior to the application of Class A concrete, square up edges in repair areas, thoroughly clean surfaces to be repaired and remove all loose materials. Remove grease, wax, salt, and oil contaminants by scrubbing with an industrial grade detergent or degreasing compound followed by a mechanical cleaning. Remove weak or deteriorated concrete to sound concrete by bush hammering, gritblasting, scarifying, waterblasting, or other approved methods. Remove dirt, dust, laitance and curing compounds by gritblasting, sanding, or etching with 15% hydrochloric acid. Only acid etch if approved and follow it by scrubbing and flushing with copious amounts of clean water. Check the cleaning using moist pH paper. Water cleaning is complete when the paper reads 10 or higher. Follow all mechanical cleaning with vacuum cleaning.

When surface preparation is completed, mix and apply concrete in accordance with Standard Specifications and/or manufacturer's recommendations. Use aggregate that is washed, kiln-dried, and bagged. Apply bonding agent to all repair areas immediately prior to placing repair mortar. Repair areas shall be formed unless otherwise approved by the Engineer. Form areas to establish the original neat lines of the member being repaired.

Apply concrete to damp surfaces only when approved. In such instances, remove all free water by air-blasting. After applying the repair mortar, remove excessive material and provide a smooth, flush surface.

Temporary Work Platform

Prior to beginning any repair work, provide details for a sufficiently sized temporary work platform at each repair location. Design steel members to meet the requirements of the American Institute of Steel Construction Manual. Design timber members in accordance with the "National Design Specification for Stress-Grade Lumber and Its Fastenings" of the National Forest Products Association. Submit the platform design and plans for review and approval. The design and plans shall be sealed and signed by a North Carolina registered Professional Engineer. Do not install the platform until the design and plans are approved. Drilling holes in the superstructure for the purpose of attaching the platform is prohibited. Upon completion of work, remove all anchorages in the substructure and repair the substructure at no additional cost to the Department.

Measurement and Payment

Concrete Repairs will be measured and paid for at the contract unit price bid per cubic foot and will be full compensation for removal, containment and disposal off-site of unsound concrete including the cost of materials, reinforcing steel, labor, tools, equipment and incidentals

necessary to accomplish removal. Depth will be measured from a place at the original outside concrete face. The Contractor and Engineer will measure repair quantities after removal of unsound concrete and before application of repair material. Such payment will also include the cost of sandblasting, surface cleaning and preparation, cleaning of reinforcing steel, placement of new reinforcing steel, cost of temporary work platform, testing of the soundness of the exposed concrete surface, furnishing and installation of repair mortar material, curing and sampling of concrete, and protection/cleaning of adjacent areas from splatter or leakage.

Reinforcing Steel that is required for the repairs will be in accordance with Section 425 of the Standard Specifications.

If bridge jacking is necessary for concrete repairs, no separate measurement or payment will be made for bridge jacking as the cost of such will be included in the price paid for "Concrete Repairs".

Payment will be made under:

Pay Item	Pay Unit
Concrete Repairs	Cubic Feet

PAINTING EXISTING STRUCTURES

REV 9/2011

Specialty Items:

Description of Work - This work shall consist of furnishing all labor, equipment, and materials to clean and paint the structural steel of the existing bridges. Work includes: removing, containment and disposal of the existing paint system; preparation of the surface to be painted and applying the new paint system; traffic control, marking & delineation; portable lighting; erosion and sediment control; seeding and mulching all grassed areas disturbed; and all incidental items necessary to complete the project as specified and shown on the plans.

The contractor shall be responsible for fulfilling all requirements of the NCDOT Standard Specifications for Roads and Structures dated January 2012, except as otherwise specified herein.

Work Schedule – Prior to the pre-construction meeting, the Contractor shall submit his work schedule to the Engineer. Schedule shall be kept up to date, with a copy of the revised schedule being provided to the Engineer in a timely manner (as determined by the Engineer).

SSPC QP-2 Certification - The existing paint systems include toxic substances such as red lead oxide, which are considered hazardous if improperly removed. Only contractors who are currently SSPC QP-2, Category A certified, and have successfully¹ completed lead paint removal on all similar structures within 18 months prior to this bid, may bid on and perform this work. **The apparent low bidder shall submit a list of projects for which QP2 work was performed within the last 18 months including owner contact information and submit to the Assistant State Bridge Management Engineer a "Lead Abatement Affidavit" by 12:00 noon of the third day following the opening of bids. This form may be downloaded from:**

<http://www.ncdot.gov/projects/nbridges/#stats>

¹ Successfully: All lead abatement work completed in accordance with contract specifications, free of citation from safety or environmental agencies. Lead abatement work shall include but not be limited to: abrasive blasting; waste handling, storage and disposal; worker safety during lead abatement activities (fall protection, PPE, etc.); and containment. This requirement is in addition to the contractor pre-qualification requirements covered by NCDOT Std. Specification, Section 102-2.

Twelve-month Observation Period - The Contractor maintains responsibility for the coating system for a twelve (12) month observation period beginning upon the satisfactory completion of all the work required in the plans or as directed by the Engineer. The Contractor must guarantee the coating system under the payment and performance bond (refer to Article 109-10). To successfully complete the observation period, the coating system must meet the following requirements after twelve (12) months service:

- No visible rust, contamination or application defect is observed in any coated area.
- Painted surfaces have a uniform color and gloss.
- Painted surfaces have an adhesion that meets an ASTM D-3359, 3A rating.

Final acceptance is made only after the paint system meets the above requirements.

Submittals - All submittals must be submitted to the Engineer for review and approval prior to the pre-construction meeting:

- Containment Drawings sealed by NC Professional Engineer
- Bridge Wash Water Sampling & Disposal Plan
- Sub- Contractor identification
- Lighting Plan for night work in accordance with NCDOT *Standard Specifications* Section 1413.
- Traffic Control Plan
 - a) NCDOT certified supervisors, flaggers and traffic control devices
- Health & safety Plan²
 - a) ²Plan must address the minimum required topics as specified by the SSPC QP-1 and QP-2 program to also include hazard communication, respiratory health, emergency procedures, and local hospital and treatment facilities to include directions and phone numbers, disciplinary criteria for workers who violate the plan and accident investigation.
 - b) Contractor shall provide the Engineer a letter of certification that all employees performing work on the project have blood lead levels that are below the OSHA action level.
 - c) Competent Person qualifications and summary of work experience.
- Environmental Compliance Plan

² SSPC QP-1 required minimum: Hazardous Materials, Personal Protective Equipment, General Health and Safety, Occupational Health and Environmental Controls, Personal Protective Equipment, Fire Protection and Prevention, Signs Signals, and Barricades, Materials Handling, Storage, Use, and Disposal, Hand and Power Tools, Welding and Cutting, Electrical, Scaffolds, Fall Protection, Cranes, Derricks, Hoists, Elevators, and Conveyors, Ladders, Toxic and Hazardous Substances, Airless Injection and HPWJ.

- Quality Control Plan (Project Specific)
 - a) Quality control qualifications and summary of work experience
- Bridge and Public Protection Plan (Overspray, Utilities, etc. - Project/Task Specific)
- Abrasive Blast Media
 - a) Product Data Sheet
 - b) Blast Media Test Reports in accordance with NCDOT *Standard Specification* Section 1080-15.
- Coating Material
 - a) NCDOT HICAMS Test Reports (testing performed by NCDOT Materials & tests Unit).
 - b) Product Data Sheets
 - c) Material Safety Data Sheets
 - d) Product Specific Repair Procedures
 - e) Acceptance letters from paint manufacturer's for work practices that conflict with Project Special Provisions and or paint manufactures product data sheets.

Pre-Construction Meeting – Submittals shall be reviewed and be approved by the engineer prior to scheduling the Pre-Construction Meeting. The Contractor shall allow for a review process of no less than two (2) weeks.

When requesting a pre-construction meeting the Contractor must contact the Engineer at least 7 working days in advance of the desired pre-construction date. The contractor's project supervisor, competent person, quality control personnel and certified traffic control supervisor shall be in attendance for the Pre-Construction meeting in order for the Contractor and DOT team to establish roles responsibilities for various personnel during project duration and to establish realistic timeframes for problem escalation.

Containment Plan - No work begins until the Contractor furnishes the Engineer with a containment plan for surface preparation and coating operations and the Engineer reviews and responds in writing about the acceptability of said plan. Allow a minimum of two weeks for review of the plan. Such plan must meet or exceed the requirements of Class 2A containment in accordance with SSPC Guide 6. Enclosure drawings and loads supported by the structure must be prepared, signed and sealed by a Registered North Carolina Professional Engineer.

In the containment plan describe how debris is contained and collected. Describe the type of tarpaulin and bracing materials and the maximum designed wind load. Describe the dust collection system and how a negative pressure of 0.03 inches of water column is maintained inside the enclosure while blasting operations are being conducted. Describe how the airflow inside the containment structure is designed to meet all applicable OSHA Standards. Describe how water run-off from rain will be routed by or through the enclosure. Describe how wash

water will be contained and paint chips separated. Describe what physical containment will be provided during painting application to protect the public and areas not to be painted.

Wash water Sampling and Disposal Plan - No work begins until the Contractor furnishes the Engineer with a containment plan for surface preparation and coating operations and the Engineer reviews and approves in writing said plan. All wash water shall be collected and sampled prior to disposal. Representative sampling and testing methodology shall conform to 15A NCAC 02B.0103, "Analytical Procedures". Wash water shall be tested for pollutants listed in 15A NCAC 02B.0211 (3), 15A NCAC 02T.0505 (b) (1) and 15A NCAC 2T.0905 (h) (See link below for NCDOT Guidelines for Managing Bridge Wash Water). Depending on the test results, wash water disposal methods shall be described in the disposal plan. Wash water shall be disposed of in accordance with all current state and federal regulations.

<http://www.ncdot.gov/projects/ncbridges/#stats>

Waste Handling of Paint and Abrasives – The Contractor will comply with the Resource Conservation and Recovery Act (RCRA – 40 CFR 261 - 265) and the Occupational Safety and Health Act (OSHA - 29 CFR 1910 - 1926) regulations for employee training, and for the handling, storage, labeling, recordkeeping, reporting, inspections and disposal of all hazardous waste generated during paint removal.

A summary of Generator Requirements is available at the above NCDOT web link which cites the specific regulations for each Generator category. Quantities of waste by weight and dates of waste generation must be recorded. Waste stored at the project site must be properly labeled.

The North Carolina Department of Environment and Natural Resources (NCDENR) have adopted RCRA as the North Carolina Hazardous Waste Management Rules and are responsible for enforcement. The "Hazardous Waste Compliance Manual for Generators of Hazardous Waste" is published by the Compliance Branch of the Division of Waste Management of NCDENR, and can be found at

<http://portal.ncdenr.org/web/wm/hw/rules>

The Contractor is required to maintain compliance with all federal, state and local regulations. Failure to comply with the regulations could result in fines and loss of qualified status with NCDOT.

Use a company from the below list of approved waste management companies or an approved equal. Immediately after award of the contract, the Contractor arranges for waste containers, sampling and testing, transportation and disposal of all waste. No work begins until the Contractor furnishes the Engineer with a written waste disposal plan. Any alternative method for handling waste must be pre-approved by the Engineer.

Southern Logistics, Inc. – 312 Orvil Wright Blvd, Greensboro, NC 27409 (Ph. 336-662-0292)
A&D Environmental – PO Box 484, High Point, NC 27261 (Ph. 336-434-7750)
Poseidon Environmental Services, Inc. – 837 Boardman-Canfield Rd #209, Youngstown, OH (Ph. 330-726-1560)
Clean Harbors Reidsville, LLC – 208 Watlington Industrial Drive, Reidsville, NC 27320 (Ph. 336-342-6106)

Waste and Wash Water Sampling

All removed paint and spent abrasive media shall be tested for lead following the SW-846 TCLP Method 1311 Extraction, as required in 40 CFR 261, Appendix 11, to determine whether it must be disposed of as hazardous waste. The Contractor shall furnish the Engineer certified test reports showing TCLP results and Iron analysis of the paint chips stored on site, with disposal being in accordance with "Flowchart on Lead Waste Identification and Disposal".

http://portal.ncdenr.org/c/document_library/get_file?p_l_id=38491&folderId=328599&name=DLFE-9855.pdf

The Competent Person shall obtain composite samples from each barrel of the wash water and waste generated by collecting two or more portions taken at regularly spaced intervals during accumulation. Composite the portions into one sample for testing purposes. Do not obtain portions of the composite sample from the very first or last part of the accumulation process. The sample(s) should be acquired after 10 percent or before 90 percent of the barrel has accumulated. Due to the difficulty of acquiring samples the intent is to provide samples that are representative of widely separated portions, but not the beginning and end of wash water or waste accumulation.

Perform sampling by passing a receptacle completely through the discharge stream, or by completely diverting the discharge into a sample container. If discharge of the wash water or waste is too rapid to divert the complete discharge stream, discharge into a container or transportation unit sufficiently large to accommodate and then accomplish the sampling in the same manner as given above.

Until test results are received, all waste shall be stored and labeled as "NCDOT Bridge Paint Removal Waste-Pending Analysis" and include the date generated and contact information for the Division HazMat Manager or Project Engineer. Waste containers shall be stored in an enclosed, sealed and secured storage container protected from traffic from all directions. A protection plan for these containers must be approved by the Engineer. If adequate protection cannot be obtained by use of existing guardrail, the contractor will be required to provide adequate protection. Once test results are received and characterized, waste shall be labeled as either "Hazardous Waste-Pending Disposal" or "Paint Waste-Pending Disposal".

Once the waste has been collected, and the quantity determined, the Contractor prepares the appropriate shipping documents and manifests and presents them to the Engineer. The Engineer will verify the type and quantity of waste and obtain a Provisional EPA ID number from the

NC Hazardous Waste Section
North Carolina Department of Environment & Natural Resources
1646 Mail Service Center
Raleigh, NC 27699
Phone (919) 508-8400 Fax (919) 715-4061

At the time of shipping the Engineer will sign, date and add the ID number in the appropriate section on the manifest. The maximum on-site storage time for collected waste shall be 90 days. All waste whether hazardous or non-hazardous will require numbered shipping manifests. The cost for waste disposal (including lab and Provisional EPA ID number) is included in the bid price for this contract. Note NC Hazardous Waste Management Rules (15A NCAC 13A) for more information. Provisional EPA ID numbers may be obtained at this link:

<http://portal.ncdenr.org/web/wm/provisional-hw-notification-page>

Testing labs shall be certified in accordance with North Carolina State Laboratory Public Health Environmental Sciences. List of certified laboratories may be obtained at this link:

(<http://slphreporting.ncpublichealth.com/EnvironmentalSciences/Certification/CertifiedLaboratory.asp>)

All test results shall be documented on the lab analysis as follows:

1. For leachable lead
 - a. Soils/Solid/Liquid- EPA 1311/200.7/6010

All sampling shall be done in presence of the Engineer's representative.

Equipment Mobilization - The equipment used in any travel lanes and paved shoulder must be mobile equipment on wheels that has the ability to move on/off the roadway in less than 30 minutes. All work conducted in travel lanes must be from truck or trailer supported platforms and all equipment must be self propelled or attached to a tow vehicle at all times.

QUALITY CONTROL INSPECTOR – The Contractor provides a quality control inspector in accordance with the SSPC QP guidelines to ensure that all processes, preparation, blasting and coating application are in accordance with the requirements of the contract. The inspector shall have written authority to perform QC duties to include continuous improvement of all QC internal procedures. The presence of the engineer or inspector at the work site shall in no way lessen the contractor's responsibility for conformity with the contract

QUALITY ASSURANCE INSPECTOR- The quality assurance inspector which may be a Department employee or a designated representative of the Department shall observe, document, assess and report that the Contractor is complying with all of the requirements of the contract. Inspectors employed by the Department are authorized to inspect all work performed and materials furnished. Such inspection may extend to all or any part of the work and to the preparation, fabrication or manufacture of the materials to be used. The inspector is not authorized to alter or waive the requirements of the contract. Each stage in preparing the structure to be coated which includes but not limited to washing, blasting, coating testing and inspection shall be inspected and approved by the Engineer or his authorized representative.

SUBLETTING OF CONTRACT:

Only contractors certified to meet SSPC QP-2, Category A, and have successfully completed lead paint removal on all similar structures within 18 months prior to this bid are qualified for this work. Work is only sublet by approval of the Engineer.

SPECIFICATIONS:

The North Carolina Department of Transportation (NCDOT) Standard Specifications for Roads and Structures dated January 2012; together with these Special Provisions apply to this project. Surface preparation and painting are performed in accordance with Section 442 except where otherwise noted in these Special Provisions. The Paint materials must meet the applicable materials specifications under Section 1080. Materials approvals are in accordance with 3.0 Materials of this Special Provision.

1.0 PREPARATION OF SURFACES:

- 1.1 Power washing – Before any other surface preparation are conducted, all surfaces shall be power washed to remove dust, salts, dirt and other contaminants. All wash water shall be contained, collected and tested in accordance with the requirements of NCDOT Managing Bridge Wash Water specification. Under no circumstances will surface preparation or painting activities be started over cleaned surfaces until all surfaces are free of standing water and dry to the touch, and then only after approval by the Engineer.
- 1.2 Blasting is done with recyclable steel grit meeting the requirements of Section 1080-15. The profile must be between 1.0 and 3.0 mils when measured on a smooth steel surface. A minimum of two tests per beam/girder and two tests per span of diaphragms/cross bracing shall be conducted and documented.
- 1.3 Tarpaulins are spread over all pavements and surfaces underneath equipment utilized for abrasive recycling and other lead handling equipment or containers. This requirement shall be enforced during activity and inactivity of equipment.
- 1.4 Before the contractor departs from the work site at the end of the work day, all debris generated during surface preparation and all dust collector hoses, tarps, or other appurtenances containing blasting residue are collected in approved containers.
- 1.5 The Contractor cleans a three inch by three inch area at each structure to demonstrate the specified finish and the inspector preserves this area by covering it with tape, plastic or some other suitable means so that it can be retained as the DFT gage adjustment standard. An acceptable alternative is for the Contractor to provide a steel plate with similar properties and geometry as the substrate to be measured.
- 1.6 The contractor and or quality assurance representative shall notify the Engineer of any area of corroded steel which has lost more than 50% of its original thickness.
- 1.7 All parts of the bridges not to be painted, and the travelling public, shall be protected from overspray. The Contractor shall submit a plan to protect all parts of bridge that are not required to be painted, in addition to a plan to protect the traveling public and surrounding environment while applying all coats of paint to a structure.
- 1.8 Contractor must insure that chloride levels on the surfaces are 7 ug/cm^2 or lower using an acceptable sample method in accordance with SSPC Guide 15. The frequency of testing shall be 2 tests per span after all surface preparation has been completed and immediately prior to painting. Test areas selected shall represent the greatest amount of corrosion in the span as determined by the Engineers' representative.
- 1.9 All weld splatter, slag or other surface defects resulting in a raised surface above the final paint layer shall be removed prior to application of primer coat.

2.0 PAINTING OF STEEL:

Paint System 1, as specified in these special provisions and Section 442 of NCDOT's Standard Specifications, is to be used for this work. System 1 is an inorganic zinc primer, two coats acrylic paint and one stripe coat of acrylic paint over blast cleaned surfaces in accordance with SSPC-

SP-10 (Near White Blast). Perform all mixing operations over an impervious surface with provisions to prevent runoff to grade of any spilled material. The contractor is responsible for reporting quantities of thinner purchased as well the amounts used. No container with thinner shall be left uncovered, when not in use.

Apply two inch (2") stripe coat by **BRUSH OR ROLLER ONLY** to all exposed edges of steel including fasteners before applying the finish coat. Locate the edge or corner in the approximate center of the paint stripe.

Any area where newly applied paint fails to meet the specifications must be repaired or replaced by the Contractor. The Engineer approves all repair processes before the repair is made. Repaired areas must meet the specifications. The Contractor applies an additional finish coat of paint to areas where the tape adhesion test is conducted.

3.0 MATERIALS:

Only paint suppliers that have a NCDOT qualified inorganic zinc primer may furnish paints for this project. All paints applied to a structure must be from the same supplier. Before any paints are applied the Contractor provides the Engineer a manufacturer's certification that each batch of paint meets the requirements of the applicable Section 1080 of the *Standard Specifications*.

The inspector randomly collects a one pint sample of each paint product used on the project. Additional samples may be collected as needed to verify compliance to the specifications.

Do not expose paint materials to rain, excessive condensation, long periods of direct sunlight, or temperatures above 110F or below 40F. In addition, the Contractor shall place a device which records the high, low and current temperatures inside the storage location. Follow the manufacturer's storage requirements if more restrictive than the above requirements.

4.0 INSPECTION:

Surface Preparation for System 1 shall be in accordance with SSPC SP-10. Any area(s) not meeting the requirements of SSPC SP 10 shall be remediated prior to application of coating. Surface inspection is considered ready for inspection when all blast abrasive, residue and dust is removed from surfaces to be coated.

Quality Assurance Inspection - The Contractor furnishes all necessary OSHA approved apparatus such as ladders, scaffolds and platforms as required for the inspector to have reasonable and safe access to all parts of the work. The contractor illuminates the surfaces to be inspected to a minimum of 50-foot candles of light. All access points shall be illuminated to a minimum of 20-foot candles of light.

NCDOT reserves the right for ongoing QA (Quality Assurance) inspection to include but not limited to surface contamination testing, adhesion pull testing and DFT readings as necessary to assure quality.

The Contractor informs the Engineer and the Division Safety Engineer of all scheduled and unannounced inspections from SSPC, OSHA, EPA and/or others that come on site and furnishes the Engineer a copy of all inspection reports except for reports performed by a third party and or consultant on behalf of the contractor.

Inspection Instruments - The Contractor furnishes at least the following calibrated instruments at site and conducts the quality control testing:

Sling Psychrometer - ASTM E-337 – bulb type
Surface Temperature Thermometer
Wind Speed Indicator
Tape Profile Tester – ASTM D-4417 Method C
Surface Condition Standards – SSPC VIS-1 and VIS-3
Wet Film Thickness Gage – ASTM D-4414
Dry Film Thickness Gage – SSPC-PA2 Modified
Solvent Rub Test Kit – ASTM D-4752
Adhesion Test Kit – ASTM D-3359 Method A (Tape Test)
Adhesion Pull test – ASTM D-4541
Surface Contamination Analysis Kit or (Chloride Level Test Kit)

The contractor maintains a daily quality control record in accordance with Section 442-12 and such records must be available at the job site for review by the inspector and be submitted to the Engineer as directed. In addition to the information required on M&T-610, the Contractor shall submit all DFT readings as required by these Special Provisions on a form equivalent to M&T-611.

The dry film thickness is measured at each spot as indicated on the attached diagram at no less than specified for each paint system as listed below:

Dry film thickness is measured at each spot on the attached diagram and at the required number of locations as specified below:

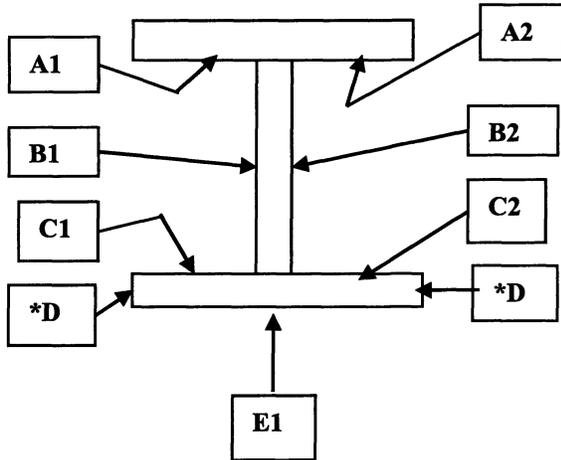
1. For span members less than 45 feet; three random locations along each girder in each span.
2. For span members greater than 45 feet; add 1 additional location for each additional 10 feet in span length.

DFT measurements for the prime coat shall not be taken for record until the zinc primer has cured in accordance with ASTM D-4752 (MEK Rub Test) with no less than a four resistance rating.

Stiffeners and other attachments to beams and or plate girders shall be measured at no less than five random spots per span. Also dry film thickness is measured at no less than six random spots per span on diaphragms/"K" frames.

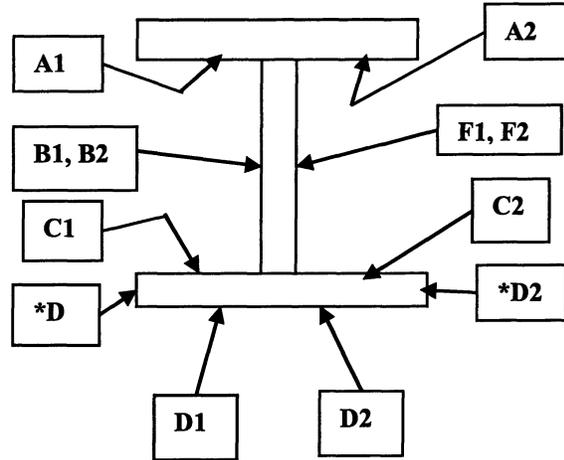
Each spot is an average of three to five individual gage readings as defined in SSPC PA-2. No spot average shall be less than 80% of minimum DFT for each layer applied; this does not apply to stripe coat application. Spot readings that are non-conforming shall be re-accessed by performing additional spot measurements not to exceed one foot intervals on both sides of the low areas until acceptable spot averages are obtained. These non-conforming areas shall be corrected by the contractor prior to applying successive coats.

Less than 36" in height and/or bottom flanges less than 16" in width.
7 Spot Areas
21 Individual DFT Readings



***D areas are only included when flange thickness is one inch (1") or greater.**

36" in height or greater and/or bottom flanges greater than 16" in width.
10 Spot Areas
30 Individual DFT Readings



***D areas are only included when flange thickness is one inch (1") or greater.**

- A. Two random adhesion tests (1 test=3 dollies) per span are conducted on interior surfaces in accordance with ASTM D-4541 (Adhesion Pull Test) after the prime coat has been properly cured in accordance with ASTM D-4752 (MEK Rub Test) with no less than a 4 resistance rating, and will be touched up by the Contractor. The required minimum average adhesion is 400 psi.
- B. Cure of the intermediate and stripe coats shall be accessed by utilizing the thumb test in accordance with ASTM D-1640 (Curing Formation Test) prior to the application of any successive layers of paint.
- C. One random Cut Tape adhesion test per span is conducted in accordance with ASTM D-3359 (X-Cut Tape Test) on interior surface after the finish coat is cured. Repair areas shall be properly tapered and touched up by the Contractor.

5.0 SAFETY AND ENVIRONMENTAL COMPLIANCE PLANS:

Personnel access boundaries are delineated for each work site using signs, tape, cones or other approved means. Submit copies of safety and environmental compliance plans that comply with SSPC QP-2 Certification requirements.

6.0 ENVIRONMENTAL MONITORING:

Comply with Section 442-13(B) of NCDOT's Standard Specifications.

A “Competent Person³” is on site during all surface preparation activities and monitors the effectiveness of containment, dust collection systems and waste sampling. Before any work begins the Contractor provides a written summary of the responsible person’s safety training.

Area sampling will be performed for the first two (2) days at each bridge location. The area sample will be located within five feet of the containment and where the highest probability of leakage will occur (access door, etc.). Results from the area sampling will be given to the Engineer within seventy-two (72) hours of sampling (excluding weekends) If the results of the samples exceed 20 ug/m³ corrective measures must be taken and monitoring will be continued until two consecutive samples come back less than 20 ug/m³.

Any visible emissions outside the containment enclosure or pump monitoring results exceeding the level of 30 µg/m³ TWA is justification to suspend the work.

Where schools, housing and/or buildings are within five hundred (500) feet of the containment, the Contractor shall perform initial TSP-Lead monitoring for the first ten (10) days of the project; during abrasive blasting, vacuuming and containment removal. Additional monitoring will be required during abrasive blasting two days per month thereafter. Results of the TSP monitoring at any location shall not exceed 1.5 ug/m³.

This project may involve lead and other toxic metals such as arsenic, cadmium and hexavalent chromium. It is the contractor’s responsibility to test for toxic metals and if found, comply with the OSHA regulations, which may include medical testing.

7.0 HEALTH AND SAFETY RESPONSIBILITY:

Comply with Section 442-13(C) of NCDOT’s Standard Specifications. Insure employee blood sampling test results are less than 50 micrograms per deciliter. Remove employees with a blood sampling test of 50 or more micrograms per deciliter from work activities involving any lead exposure.

An employee who has been removed with a blood level of 50 micrograms per deciliter or more shall have two consecutive blood sampling tests spaced one week apart indicating that the employee’s blood lead level is at or below 40 micrograms per deciliter before returning to work activities involving any lead exposure.

Prior to blasting operations the Contractor shall have an operational OSHA approved hand wash station at each bridge location and a decontamination trailer at each bridge or between bridges unless the work is on the roadway, or the contractor can show reason why it is not feasible to do so in which the Contractor will provide an alternative site as approved by the Engineer. The contractor shall assure that all employees whose airborne exposure to lead is above the PEL shall shower at the end of their work shift.

All OSHA recordable accidents that occur during the project duration are to be reported to the Engineer within twenty four (24) hours of occurrence. In addition, for accidents that involve civilians and or property damage that occur within the work zone the Division Safety Engineer shall be notified immediately.

³ **Competent Person** as defined in OSHA 29 CFR 1926.62 is one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who have authorization to take prompt corrective measures to eliminate them.

8.0 STORAGE OF PAINT AND EQUIPMENT:

The Prime Contractor provides a location for materials, equipment and waste storage. Tarpaulins are spread over all pavements and surfaces underneath equipment utilized for abrasive recycling and other lead handling equipment or containers. All land and or lease agreements that involve private property shall disclose to the property owner that lead and other heavy metals may be present on the Contractor’s equipment. Prior to storing the Contractor’s equipment on private property the Engineer shall receive a notarized written consent signed by the land owner submitted at least forty-eight (48) prior to using property. All storage of paint, solvents and other materials applied to structures shall be stored in accordance with Section 442 of the Specifications or manufacturers’ requirements. The more restrictive requirements will apply.

9.0 UTILITIES:

The Contractor protects all utility lines or mains which may be supported on, under, or adjacent to bridge work sites from damage and paint over-spray.

10.0 PAYMENT:

The cost of inspection, surface preparation and repainting the existing structure is included in the lump sum price bid for *Cleaning and Repainting of Bridge #___*. This price is full compensation for furnishing all inspection equipment, all paint, cleaning abrasives, cleaning solvents and all other materials; preparing and cleaning surfaces to be painted; applying paint in the field; protecting work, traffic and property; and furnishing blast cleaning equipment, paint spraying equipment, brushes, rollers and any other hand or power tools and any other equipment; containment, handling and disposal of debris and wash water, all personal protective equipment, and all personal hygiene requirements.

Pollution Control will be paid for at the contract lump sum price which price will be full compensation for all collection, handling, storage, air monitoring, and disposal of debris and wash water, all personal protective equipment, and all personal hygiene requirements, and all equipment, material and labor necessary to fully contain the blast debris; daily collection of the blast debris into specified containers; and any measures necessary to ensure conformance to all safety and environments regulations as directed by the Engineer.

Payment will be made under:

Pay Item	Pay Unit
Cleaning and Repainting of Bridge #___	Lump Sum
Pollution Control	Lump Sum

DESCRIPTION OF BRIDGE

Bridge #200: The bridge was built in 1960 and is located on Fairview Rd over Capital Blvd. (US-401) in the city of Raleigh in Wake County, NC. The bridge has an overall length of 177’± and consists of 3 spans. Span A is approximately 63’± in length. Span B is approximately 78’± in length. Span C is approximately 36’± in length. The total bridge width is approximately 39’-6” out to out. Spans A, B and C consist of rolled steel beams. There are a total of 6 lines of beams/girders in each span. Existing structural steel is painted non-weathering steel and the

estimated area to be cleaned and painted is **9400 sq. ft.** based on the requirements of Paint System 1 in the Standard Specifications for coverage of all visible structural steel.

Paints on all bridges (regardless of color), contain red lead and other hazardous constituents. All cleaning and surface preparation activities must prevent dispersion of debris into the environment.

Surface area shown is approximate and may vary from the actual quantity to be painted. The Contractor is responsible for determining the actual area to be painted.

MANAGING BRIDGE WASH WATER

1.0 Description

Collect and properly dispose of Bridge Wash Water from bridge decks.

2.0 Construction Methods

- (A) Prepare a written Bridge Wash Water management plan in accordance with the Guidelines for Managing Bridge Wash Water available at <http://www.ncdot.org/doh/preconstruct/ps/contracts/letting.html>. Submit plan and obtain approval from the Engineer prior to beginning of the bridge cleaning operation.
- (B) Prior to final payment, submit a paper copy of all completed records pertaining to disposal of Bridge Wash Water.

3.0 Measurement and Payment

Payment for collecting, sampling, testing, pH adjustment, monitoring, handling, discharging, hauling, disposing of the bridge wash water, documentation, record keeping, and obtaining permits if applicable, shall be included in the payment for other items.